SCIENTIFIC AMERICAN

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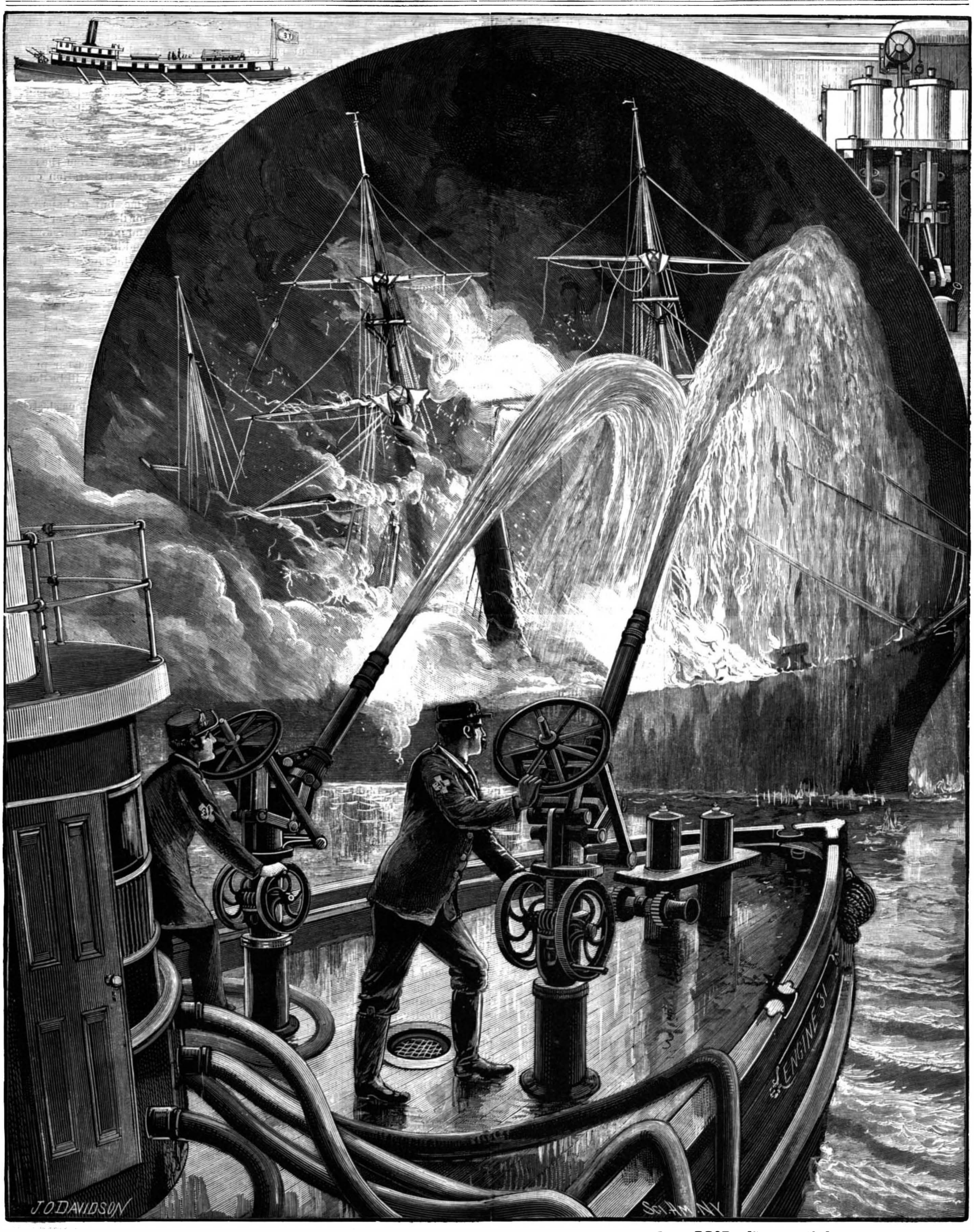

"FIRE ENGINE No. 31"—THE NEW FIRE BOAT IN USE IN BOSTON HARBOR.—[See page 135.]

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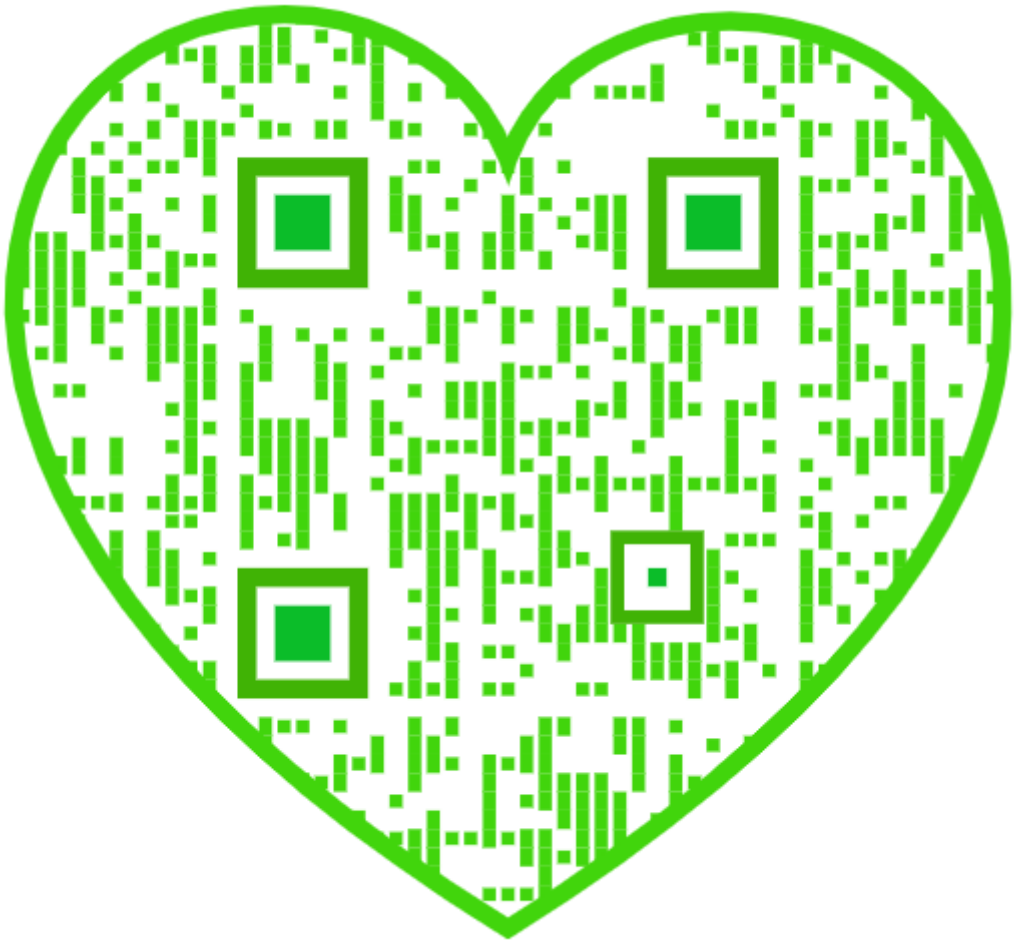

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THE WORLD'S FAIR.

The Legislature of the State of New York has passed the world's fair bill, authorizing the holding of an exposition in the city of New York in commemoration of the discovery of America four hundred years ago. The city is authorized by this law to raise and expend ten millions of dollars for the acquiring of land and the erection thereon of buildings for exhibitions of art, science, and other objects of this nature. This liberal allowance, added to the guarantee fund, which no wexceeds five millions of dollars, puts the whole enterprise on an admirable financial basis. At Washington, the advocates of four cities presented their claims, St. Louis, Washington, and Chicago being competitors with New York. It seems probable, however, that the general consensus of all who have dispassionately studied the subject favors New York.

The question of site has been already discussed at length in these columns. The tract of land finally settled upon has won universal commendation from all who have the success of the fair at heart. We have illustrated it recently, and its striking features of excellence are now known to all. There is one point in connection with this choice that may yet cause trouble. A great deal of private property is included within the limits. A number of owners have agreed to make favorable arrangements with the commissioners, to the effect that they will cede the use or the fee simple of their property for the purposes of the exhibition. Many of these offers indicate a sacrifice of interest that is highly to be praised, and which represents a true subscription to the object in view. But other property owners seem indisposed to yield to the popular demand, and it is probable that there will be difficulty in acquiring possession of much of the territory required. The owners of real estate will probably contest the legality of condemnation proceedings, and at this late period the risk of delay cannot be encountered.

The above is more than a possibility. It is so probable that it is satisfactory to feel that there are several ways of escape from the difficulty. One of them has already been suggested by us. The area of Riverside Park could be extended by widening or carrying out a flooring over the steep banks of the park fronting on the river. The park could thus be made sufficient in itself for all principal buildings, while Morningside Park would accommodate any overflow from the main grounds. There would be no difficulty in executing this work, and the space thus covered would be very attractive.

Another way, if difficulty arises as to the present site, would be to abandon the site entirely. The city owns large areas of land elsewhere, in the form of park property, much of which is yet unimproved to any extent. The fair could be relegated to some of these places. Inwood Park, about five miles north of the present proposed site, would answer every purpose. It seems a pity to abandon the unequaled advantages of a long and elevated frontage upon the Hudson River, and the central position as now chosen, but the advantages of other sites are also many. Should the contention by property owners prevail, and be settled in their favor to the exclusion of the fair from the contemplated site, harm will have been done, but the fair will still have a metropolitan site, and one which will give its organizers every chance to excel the greatest exhibition hitherto held in any country.

ELECTRO-MOTORS ON TRUNK LINES.

At the recent meeting of the National Electric Lighting Association, one of the best authorities on the electro-motor, F. J. Sprague, of New York, gave some interesting testimony concerning its present condition and future prospects. The most unobservant can scarce have failed to see that it is rapidly taking the place of horses for street car traction, and he thinks it will displace the cable. The flexibility of the electrical system, the ease with which it is extended, its adaptability to various conditions of service, freedom from long-continued breakdown, and the advances which have been made in perfecting its apparatus would seem to insure its supremacy.

Will the electro-motor take the place of the locomotive on trunk lines? That is a question which has been guessed at by those more or less competent. Mr. Sprague, perhaps as capable as any authority, answers: "Probably not, according to present notions of trunk line transportation and by present methods of train dispatching." But he has a plan to propose, or rather a prophecy to make, indicating the point at which motor practice is likely to trend upon the domain of the locomotive.

It is only a question of supplying energy along a line and deciding what is the best potential to work with. On say a line like that from Jersey City to Philadelphia, while he would not attempt, at least at present, to follow the regular train service system, by one more adapted to electro-motors a still more expeditious and convenient one could be supplied. Beginning by describing the existing conditions now prevailing in the Pennsylvania Railroad service between the points mentioned, he finds that from 8 A. M. to 9 P. M., a period of 13 hours, 21 regular trains leave the Jersey City station for Philadelphia. Twelve of these make only one or two stops. The others make more or less stops, according to the running schedule. In addition to these there are a number of local trains serving way stations. Taking the through trains only, and allowing an average say of five cars to a train, there are in the 13 hours about 105 through cars dispatched from Jersey City, or at the rate of one car every 7½ minutes, and of the through cars not making over one or two stops there would be one every 13 minutes.

Supposing an additional track to have been built, leaving the distance about what it is now, say 90 miles, with the grades eased and the worst curves rectified, the through cars could be dispatched in two-car unit on a perfect block system, and run through to Philadelphia with not more than one stop at fixed intervals, and at say 60 miles an hour, making the trip in 1½ hours.

In other words, he would employ the same number of cars as are now employed by the railroad company in its express trains, but instead of sending them in trains at long intervals, he would start two cars on the road to Philadelphia every 13 minutes. With careful figuring he finds that with one station in the middle of the route the potential at the farthest from the station would be 3 616 volts, and near the station one-ninth higher. He says:

"Can we handle it? Yes, in time, but perhaps not yet. Nor is there any necessity for doing so; for if we increase the number of stations and go to a three-wire instead of a two-wire system, making the track the balance of circuit, we would have the motor potential as expressed by the following table:

STATIONS.		MOTOR POTENTIAL.	
Number.	Miles apart.	2-wire.	3-wire.
1	..	3,516	1,808
2	45	1,808	904
3	30	1,205	603
4	22½	904	452

which last brings us down to ordinary street car practice, which is only the beginning of what will be done in the effective handling of potentials.

"So, after all, it does not seem such a serious electrical problem, and certainly not one to shrink from.

"The supposititious case is well within the range of possibilities. A 60 mile express service every ten minutes instead of a 40 to 45 mile service every hour would revolutionize travel. Of the comforts of such a system I need not speak. That it will in the not very distant future be a fact, I know you all agree with me in hoping."

S. J. PERRY.

The saddest news in connection with the late solar eclipse is the death of the Rev. Father Perry, chief astronomer in charge of the English government expedition to Cayenne. The story of his death reveals extraordinary devotion to duty. He was seized with dysentery shortly before the time of the eclipse, and while suffering greatly and hardly able to walk, supervised the operations and secured perfect exposures for photographs of the eclipse. He personally conducted the work at one instrument. After all was over he gradually grew worse, and was taken on board the ship, which set sail for Barbados. He died on shipboard before the island was reached, and was buried there—a true martyr to science. Death occurred at sea on December 26, at 4:15 P.M. By his death England has lost one of her greatest astronomers. The amiable character of the man and his devotion to his duty are strikingly revealed in the detailed accounts of his death that have reached us. For many years he was a professor in Stonyhurst College in England, and his work brought the college observatory, for twenty-five years under his charge, into high reputation in the astronomical world.

WILLIAM JARVIS McALPINE.

On February 16 of the present year this eminent civil engineer died, after a long life of usefulness in his profession. He was born in 1812, and received a common school education in this city. He began his career as an engineer upon the Erie Canal, and remained connected with that work until 1846, being one of the chief engineers. He next received an appointment from the Federal government, being made chief engineer of the Brooklyn Navy Yard dry docks. In 1857 he was elected State Engineer of the State of New York, and two years later was made a State Railroad Commissioner. One of the trophies of his life was won in 1870, when his plans for the improvement of the cataracts of the Danube River were accepted by the Austrian government, he having to compete with the leading engineers of Europe. The Chicago water works were constructed under his supervision. He was elected president of the American Society of Civil Engineers for 1868–69, and was the first American elected an honorary member of the London Society of Civil Engineers. His opinions on the recent failure of the South Fork dam, bringing about the destruction of Johnstown, were widely quoted, as he was considered a high authority on earth-work dams.

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Execution by Electricity.

The committee appointed by the New York State Prison Superintendent to test the efficiency of the electrical appliances and dynamos placed in the State prisons, for the execution of condemned murderers by electricity instead of by hanging, has made its report to the superintendent. The committee consisted of Carlos F. Macdonald, M.D.; A. D. Rockwell, M.D; Louis H. Laudy, Ph.D.

The contract for appliances with which to carry out the law called for "one 650 light alternating current dynamo with electro-motive force variable at will from 1,000 to 2,000 volts in each one of the three State prisons, each dynamo to be furnished with an exciter and rheostat." A Cardew voltmeter and some other apparatus were also to be placed in one of the State prisons which the superintendent might specify. The method employed by the committee to determine the electromotive force of the dynamos was to measure, by means of a Cardew voltmeter, the full potential along a resistance of German silver wire. The committee says:

"With this end in view were constructed four frames, each holding 100 ohms of No. 15 German silver wire. The 100 ohms were divided into portions of ten ohms each. In parallel with each of these portions was put a fifty volt lamp of twenty candle power. The object of the wire was to maintain the potential when the Cardew voltmeter was applied to the lamps. The voltage between each lamp was taken with a Cardew voltmeter which had been previously calibrated.

"This method furnished a ready though inexact means of observing the potential from the candle power of the lamps. The exact measurements were made with the Cardew voltmeter applied successively."

The committee says that "the term electromotive force, as used to express potentials on an alternating current, needs definition," and these definitions are given:

"1. A commercial voltage of, say, fifty volts is such an alternating voltage as will, upon an incandescent lamp or Cardew voltmeter, produce the same light and heat effects as fifty volts in the case of a continuous current.

"2. In alternating current dynamos the electromotive force undergoes rapid periodic changes, being at one instant zero, increasing to a maximum, diminishing again to zero, then reversing in direction, it again rises to a maximum, to fall again to zero. This cycle of changes is usually repeated many times in a second. The average of these rapidly changing strengths is sometimes called the electromotive force of the dynamo.

"3. Sometimes the maximum of electromotive force obtained in the cycle of changes is called the electromotive force of the dynamo, hence the figures will vary according as the electromotive force acting in any apparatus is expressed in accordance with one or the other of these definitions."

The committee adds: "In the following tables the results are stated in the three ways referred to, namely, commercial, mean, and maximum:

SING SING PRISON.

Commercial voltage	1,560
Mean voltage	1,404
Maximum voltage	2,206
Speed of dynamo	1,650
Speed of exciter	2.100

"The dynamo tested was an alternating current intended to supply 750 incandescent lamps of sixteen candle power each.

AUBURN PRISON.

Commercial voltage	1,680
Mean	1,512
Maximum	2,376
Speed of dynamo	1,700
Speed of exciter	2,700

"The dynamo tested was an alternating current intended to supply 650 incandescent lamps of sixteen candle power each.

CLINTON PRISON.

Commercial voltage	1,170
Mean	1,053
Maximum	1,655
Speed of dynamo	1,500
Speed of exciter	1,800

"The dynamo tested was an alternating current intended to supply 650 incandescent lamps of sixteen candle power each. These quantities were the maximum that the committee could obtain with the machinery at their disposal."

The report concludes as follows:

At Auburn prison the committee tested the deadly energy of the current on a calf and also on a horse, the latter weighing about one thousand pounds. Placing one electrode on the forehead of the horse and the other on the outer aspect of the hind leg just above the gambrel, a current of electromotive force of 1,200 volts was passed. Death was instantaneous.

In order to throw light upon the question as to the possibility of resuscitation after apparent death by electricity, Dr. George E. Fell, of Buffalo, was invited to be present with an apparatus devised by him for this purpose. Immediately after the calf had received the electrical stroke Dr. Fell opened the windpipe and inserted the tube of the apparatus, and for half an hour kept up forced respiration, but failed to elicit any evidence of life. This demonstrated that the condition was not one of suspended animation, but of death.

At Clinton Prison a young bull, weighing about six hundred pounds, was instantly killed by a current of 900 volts. On receiving the full force of the current, 900 volts, the animal fell and instantly the muscles relaxed, owing to a drop in the voltage from 900 to 400. The period of contact was continued, however, for ten seconds; but as the experiments have shown that a current of 400 volts is hardly sufficient to kill one of the larger animals, the conclusion that the bull was killed by the instantaneous impact of 900 volts is inevitable.

Drs. Macdonald and Rockwell, of the committee, had previously experimented on various animals, including dogs, calves, and horses, and had found that a current of 1,000 volts was sufficient to instantly kill a horse, while one of 500 volts was all that was necessary to kill dogs and calves weighing as high as 75 pounds.

In all these experiments the contact varied from ten seconds at the lowest to twenty seconds at the highest. The minimum time necessary to effect death was not accurately determined.

From the tests of the dynamos, as described, together with the experiments on animals, which were regarded as satisfactory, the committee entertains no doubt as to the efficiency of the three dynamos at Sing Sing, Auburn, and Dannemora to accomplish the work for which they are intended.

"Experimental Science."

Rarely does a book upon any subject find purchasers among all classes of people. This is especially true in regard to scientific books. The majority of book buyers are seeking information on some special subject, and as a consequence purchase only such books as are useful in one particular line; but notwithstanding this, there is an unmistakable inclination on the part of many people in widely different walks of life to acquire at least a general knowledge of the principles underlying all modern industries based on early or recent developments in physical science. To us this has been particularly noticeable since the publication of our new book by Mr. Geo. M. Hopkins, entitled "Experimental Science."

We find that it meets with a large sale, not only among science teachers and students, but also among men of every profession. Persons in almost every line of business have manifested their interest in science by the purchase of this book. From many of these we have had letters expressing great satisfaction with the character of the work. The book has proved itself to be exactly suited to the use of those who desired to secure by the experimental method a good knowledge of magnetism, electricity, electrical measurements, heat, light, polarized light, photography, microscopy, acoustics, pneumatics, hydraulics, and the wide range of other subjects included under the general title of physics.

James Watt the Inventor of the Letter Copying Press.

In his recent inaugural address before the University of Glasgow, Prof. Archibald Barr, after speaking of Watt's steam engine discoveries, says:

Watt's other inventions are too numerous to mention, and most of them—such as the parallel motion, the governor, and the steam engine indicator—are well known to have come from him. But the very multitude of his inventions makes his name to be little associated with some of his most fruitful works. Had he made no other invention, or had he been of a more self-assertive disposition, his name would probably have become known wherever business is conducted, in connection with his invention of the method, still almost universally in use, of copying letters by means of the copying press.

It would seem to be the common fate of all great and novel inventions to raise a storm of opposition from those whom they are most calculated to benefit. Dudley's invention of the process of smelting iron by means of coal instead of charcoal brought him only persecution from the iron masters and the destruction of his works by rioters at their instigation. The steel makers of Sheffield attempted to get the government to prohibit Huntsman from working his great invention—the cast steel process—and nearly succeeded in driving the cutlery trade out of their own hands and out of Sheffield. David Mushet's discovery that the "wild coals" were ironstones of great value excited for years a strong prejudice against him in the minds of the iron masters of Scotland, who have since made not only their own fortunes, but in great measure the Scotland of to-day, through the working of those blackband ores. Neilson's invaluable invention of the hot blast for smelting furnaces was not only ridiculed by the iron masters, but so stoutly resisted that for years he was unable to get it even tried on a practical scale. So again the landed proprietors, who had perhaps most to gain from the opening up of communications through the country, strongly opposed the early railway projects. They supposed that they were to be reduced to beggary by the "infernal railroads," as one land owner called them, declaring that he "would rather meet a highwayman, or see a burglar on his premises, than an engineer!" Many more such instances might be quoted.

We need not, therefore, be surprised to find that Watt's copying process, though brought out practically in its present state of perfection, found little favor at first with many business men; but it is curious now, after the invention has for more than one hundred years been almost indispensable to the class of men who then resented its introduction, to read of the bitterness of the opposition which it met with. The fear that "it would lead to the increase of forgery" ran so high that on one occasion when Smeaton and Boulton (Watt's partner) were sitting in a London coffee house, they heard a gentleman exclaiming against the copying machine, and "wishing the inventor was hanged and the machines all burnt." No one could attempt to estimate the value to the world of this single invention, and still comparatively few people now know to whose labors and knowledge they owe the boon.

PHOTOGRAPHIC NOTES.

Mounting Large Prints.—Notwithstanding that of late India rubber rollers are much employed for mounting prints, I find that a stiff bristle brush is much superior to anything else for insuring perfect adhesion of the prints to the mounts. Use it as follows: Paste your print, lay the mount upon it, turn it over with the print adhering to it, lay a sheet of tissue paper over the print, then brush it down, commencing from the middle of the print.

No air bubbles will remain, neither will the largest prints be strained or distorted. A small clothes brush, or such a one as is used by copper plate printers to brush their paper with, is the kind to use.

Removing Emulsion from the Backs of Negatives.—Plate makers continue to be very generous with their emulsion—on the reverse of plates, just where it is not required. This, of course, must be cleaned off, in order to prevent a separation of molecules under the pressure of the printing frame. A better instrument for this purpose can hardly be imagined than a ball of horsehair, such as is used by copper plate printers to assist in freeing their hands from ink (they call it a "tuzzy"). Apply this to the back of the plate upon removal from the fixing bath, then rinse under the tap.—*C. T. Chesterman in the Photographic Review.*

Light and Health.

Most persons would say that the outside light is two or three times as strong as that within our houses. But the ratio of difference is vastly greater. Carefully prepared tables show that for a view at the seashore, comprising sea and sky mainly (with a lens and plate of a certain speed), an exposure of one-tenth of a second is sufficient. An open landscape away from the sea would, with the same lens, the same aperture, and the same plate, require one-third of a second. A fairly lighted interior would require two and a half minutes, while a badly lighted interior, such as rooms which most ladies prefer to occupy, would require half an hour to obtain an equally good picture. In other words, patients strolling on the seashore in sunny weather are in a light not two or three times, but eighteen thousand times stronger than that in the ordinary shaded and curtained rooms of a city house; and the same patients walking along the sunny side of a street are receiving more than five thousand times as much of the health-giving influence of light as they would receive indoors in the usually heavy curtained rooms.—*Health.*

THE Niagara River Hydraulic Tunnel, Power, and Sewer Company will now, it is stated, carry out its plan for utilizing the fall of water at Niagara, by building its main tunnel and connecting cross tunnels with wheel pits. The estimate of cost is $2,250,000. It is estimated that if thirty mills of 500 horse power each are built, it would pay five per cent upon a capital of $3,000,000, while if all privileges were taken the result would pay the interest upon a large block of bonds and a handsome return upon the stock. One of the best known banking houses in Wall Street is deeply interesting in this undertaking. The scheme is one of sound engineering and is thoroughly practicable.—*The Electric World.*

THE Automatic Phonograph Exhibition Company, of New York city, has been incorporated in this State with a capital stock of $1,000,000. It is formed to manufacture, lease, use, and sell a nickel in the slot machine, by means of which the dropping of a coin in the slot will operate a mechanism which will cause a phonograph or phonograph-graphophone to produce the sound recorded upon its cylinder, and after such reproduction cause the diaphragm to return to its original position. The trustees of the company are Felix Gottschalk, Willard L. Candee, Thomas T. Eckert, Jr., Richard W. Stevenson, Victor E. Burke, John E. Prague, and James Molinari.—*The Electric World.*

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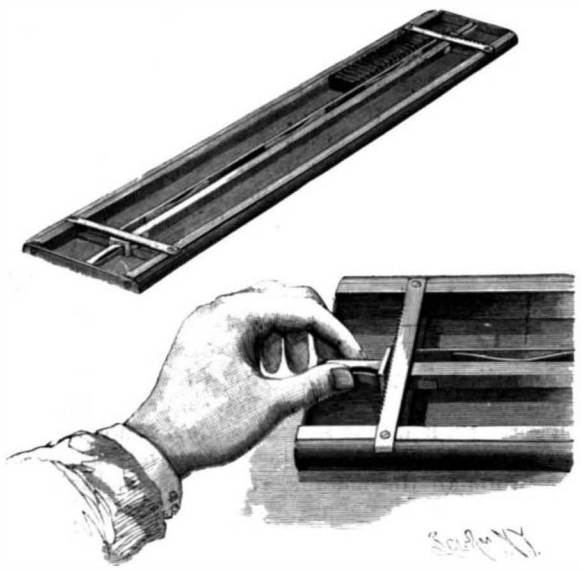
AN IMPROVED PRINTER'S GALLEY.

A printer's galley in which the type may be locked in position without using the ordinary wooden quoin is shown in the accompanying illustration, and has been patented by Mr. William S. Rogers, of Los Angeles, Cal. Near the ends of the galley are secured toothed cross bars, through slots in which extend stems rigidly connected to a bar extending lengthwise of the galley, the teeth in the cross bars being a nonpareil em apart. These teeth on each crossbar are engaged by a spring-pressed pawl through which the stems of the longitudinal bar pass. The longitudinal bar is inclosed in a case, with bow springs between the bar and the case, the bar and its case thus forming a two-part side stick having a yielding working case. A spring may also be arranged at each end of the longitudinal bar to draw the bar to one galley flange. Type placed in position on this galley will be held to place without using the ordinary furniture and quoins.



ROGERS' PRINTER'S GALLEY.

For further information relative to this invention address the inventor or Mr. Julius Copp, box 1426, Los Angeles, Cal.

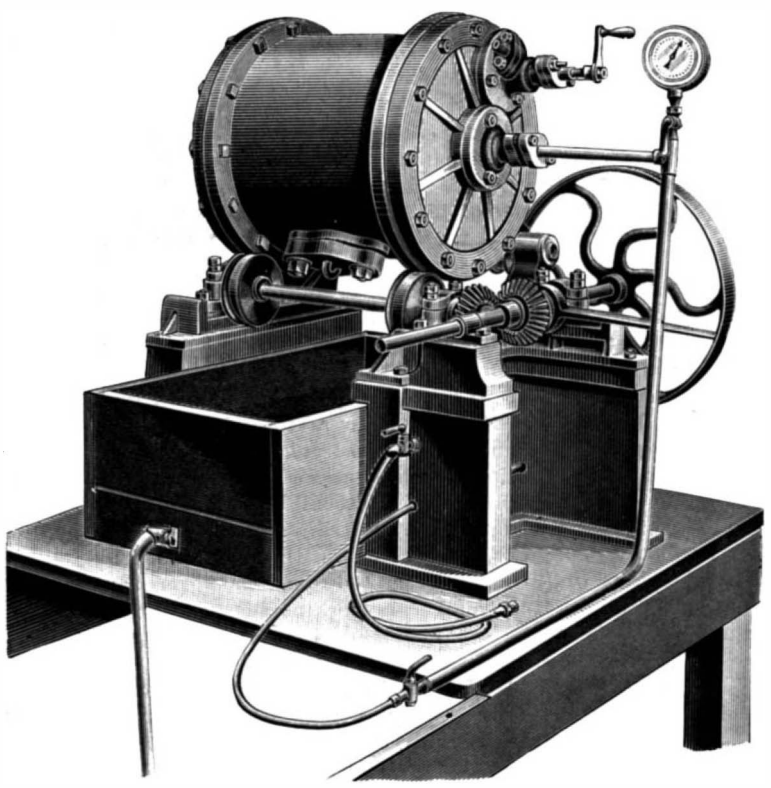
HYDRAULIC PRESSURE GOLD CHLORINATION PROCESS.

We annex an illustration of a chlorinating cylinder in which, by the application of hydraulic pressure, gold is extracted from refractory ores. The process is the invention of Mr. J. Holms Pollok, B.Sc., of the Glasgow University, and is thus described by *Engineering:*

The ore to be treated is first crushed to about the fineness of sand, preferably by rollers, to avoid as far as possible the presence of much fine dust. It is then, when necessary, roasted at a dull red heat for about six hours, which removes the sulphur and renders the ore porous or spongelike. If much sulphur is present the roasting takes somewhat longer, and if copper, lead, zinc, etc., are present, about 5 per cent of salt must be added, so as to chlorinate these metals in the furnace and prevent them consuming the chlorine in the subsequent operations. After roasting, the ore is raked from the furnaces and allowed to partially cool, it is then placed in the chlorinating cylinders in charges of about one ton of ore at a time, together with 30 pounds of bleaching powder and 40 pounds of niter cake, or about 1½ per cent of bleaching powder and 2 per cent of niter cake. So soon as the ore and reagents are placed in the cylinder the cover is screwed over the charging door and the valve on the hydraulic pipe opened, when the water is forced in to a pressure of about 100 pounds per square inch. Considerable advantage is gained by allowing the air initially present in the cylinder to escape during the admission of the water, as it acts detrimentally in wasting chlorine. This may easily be done by opening the cock, afterward used for blowing off the excess of chlorine, and closing it as soon as the air has escaped and the cylinder is full of water.

The cylinder is then revolved for one hour, when the niter cake reacts with the bleaching powder, liberating chlorine gas, and as there is no air in the machine, the whole of the chlorine passes into solution, and the high and steadily applied pressure drives this strong chlorinating liquid into the pores of the ore, so that the gold contained is rapidly and completely converted into the chloride and dissolved in water. The cylinder sits on four friction wheels and is revolved by a shaft passing through two of these. The hydraulic pipe passes through the center of one end of the machine and is connected to the machine by a packing box, which, while it keeps the pipe perfectly tight, leaves the machine free to revolve. By this means the pressure of 100 pounds per square inch is maintained throughout the whole operation. Immediately beyond the packing box is placed an automatic rubber valve, which admits water under pressure, but prevents any ore or chlorine solution from finding its way back into the pipe from the accumulator. After the chlorination is over the cylinder is stopped revolving, and the excess of chlorine blown off by connecting a flexible pipe to a stop cock on the top of the cylinder. The cover is then removed from the charging door and the ore and solution of gold run into a filter. The liquor is then pumped out of the filter into precipitating tanks, where the gold is thrown down by ferrous sulphate (1½ per cent) or sulphureted hydrogen, or, if preferred, it may be precipitated by running the solution through a bed of charcoal, the charcoal being afterward burned. The gold is then collected and fused into bars. Coarse gold when present is obtained by running the refuse from the chlorinator over amalgamated copper plates.

The inventor does not claim that the process is new in its entirety. What he does claim is that, by the application of hydraulic pressure in the process of chlorinating under pressure, one can operate better, quicker, and cheaper than by any method hitherto in use. The cost of treatment of ore in England is estimated as $1.50 per ton. In reckoning the cost at the gold fields it is necessary to include freightage. Ore has been received from all gold and silver producing countries in the world, and there has been extracted on the average 95 per cent of the gold present in pyrites or float gold ores.



HYDRAULIC PRESSURE CHLORINATION PROCESS.

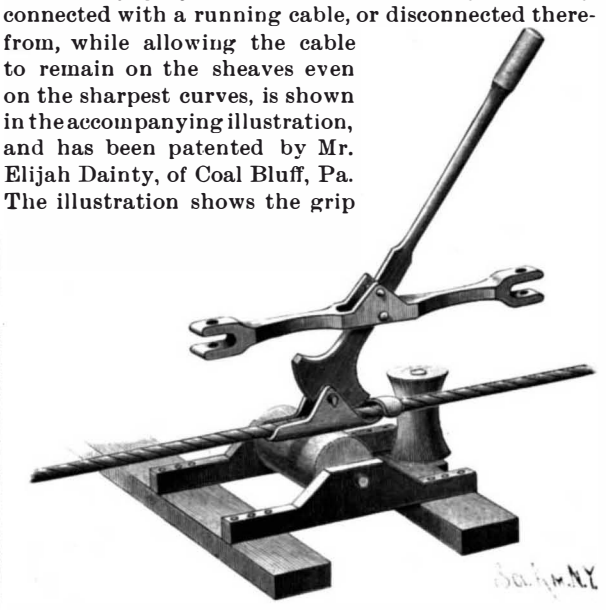
Practical Vision Testing.

Mr. Brudenell Carter, well known ophthalmologist, has been lecturing to the Society of Arts on practical vision testing. The greater part of the lecture was devoted to color blindness and the means of testing it, so that it is not surprising, says the *Chemist and Druggist*, that controversial and personal matters had a larger share of the discourse than is commonly to be found in lectures delivered to the general public. There are several methods of testing color blindness, and one of the objects of the lectures was to point out that the tests employed for those in the public service, as, for example, in the examination of seafaring men and of engine drivers, are not sufficiently crucial, and men who are really color blind can be "coached" to pass the examination in this subject, but this coaching does not extend its influence so far as to prevent collisions. It is unnecessary to enter here into the merits of the respective tests which are used; but when such authorities as Mr. Brudenell Carter state that they do not completely guard the public against danger, it is time that some steps were taken to test the truth of the assertions.

In regard to vision testing for the selection of spectacles and similar purposes, Mr. Carter said that printed types, of regulated sizes, are much used for vision testing, and answer fairly well for many purposes; but they are inferior, in the accuracy of the results which they afford, to those groups of spots which correspond with the anatomical structure of the retina. The best kind of spots are hexagonal in shape, and the best mechanical arrangement for testing vision by groups of dots is to have a series of these groups placed in a circle near the margin of a revolving wheel, which again is placed behind a disk with a marginal aperture of such a size as to disclose one group at a time. The person to be examined is placed at the proper distance (50 meters), in proper light, and the disk is turned round. As each group of dots is disclosed, the person tested should name the number of dots composing it, rapidly and without mistake. Whoever can do this has normal vision. If the examinee makes mistakes, the next step is to allow him gradually to approach the dots until he reaches a distance at which his mistakes cease. The difference between the distance at which he ought to see and the distance at which he can see permits the degree of acuteness of vision which he possesses to be stated in a fraction with absolute accuracy.

AN IMPROVED CABLE GRIP.

A cable grip by means of which a car may be readily connected with a running cable, or disconnected therefrom, while allowing the cable to remain on the sheaves even on the sharpest curves, is shown in the accompanying illustration, and has been patented by Mr. Elijah Dainty, of Coal Bluff, Pa. The illustration shows the grip as it would appear applied to a cable passing over a roller and around the pulley or sheave on a vertical axis at a curve in the track. The shoe has a semicircular part, through the top of which passes the cable, the under side of this part being rounded off at the ends so as to easily pass over the sheaves, while one end of the shoe has an overhanging curved flange to prevent the cable from jumping out of the shoe. The cable is clamped in the shoe by a cam pivotally connected with the shoe in its middle by a pin passed through upwardly extending flanges of the shoe and the cam, the latter being formed on the lower end of a lever fulcrumed on a pin held in a coupling link or bracket, which is here shown as a link adapted for connecting the adjoining ends of two cars to be moved by the cable. The pin connecting the cam with the shoe has an offset on one end, and on its other end a short arm extending in an opposite direction, whereby the pin will always be held from falling out of place. The lever operating the cam may be adjusted to a vertical position by means of a pin adapted to pass through apertures formed in flanges of the link and through a central aperture in the lever, and when the lever is so adjusted the cam is disconnected from the cable; but when the lever is pushed to one side, and thus held by passing the pin directly through the flanges over the lever, as shown in the engraving, the cam then engages the cable and clamps the latter in the shoe. The cam and the link are preferably made double to permit of attaching the cable grip to either end of a car.



DAINTY'S CABLE GRIP.

Cheap Photographic Washing Troughs.

For Plates.—Take a metal plate box and make a very small hole, as small as you can, at the bottom. Put the plate in that you want to wash, and let the tap drip into the box rather faster than the water can run out through the hole at the bottom. The excess will of course run over the top, but the hypo will escape at the lowest point. Some plate boxes are made so that the glass projects over the top. These do not answer the purpose.

For Prints.—What you want to do is to introduce the supply of fresh water at the bottom, so that it mixes with and carries away any hypo accumulation that settles down. This can be done by putting a bit of elastic tubing over the nozzle of the tap long enough to reach to the bottom of the vessel.

But an easier plan is to use a funnel. There are two ways of doing this, either let it stand on its big end in the basin with its small end projecting over the surface (see that it is exactly under the tap, so that the drip falls down the tube and comes into the basin under the rim of the big end), or, if you have anything you can make a foot of, you can put the big end upward. I use a small earthenware funnel for this that has no straight part. If the side of the basin is tolerably upright, it is enough to rest the side of the big end of the funnel against the side of the basin and let the drip pass through the former.—*Q. D. in British Journal of Photography.*

RECENT discoveries made by the use of the spectroscope show that all the heavenly bodies appear to be composed of the same chemical elements.

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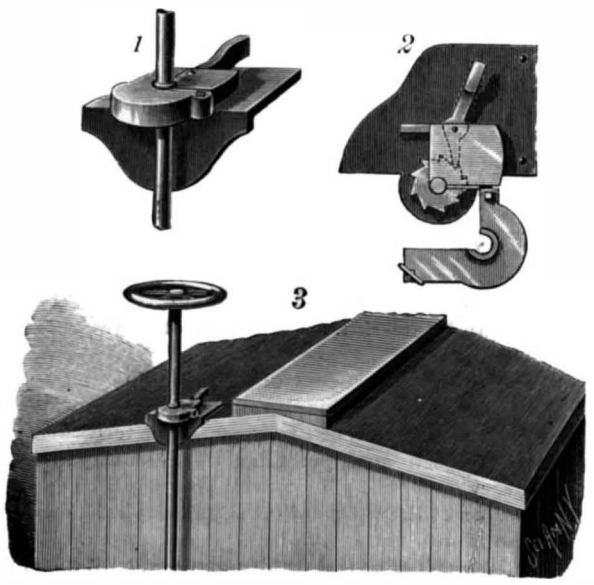
AN IMPROVED BRAKE STAFF SUPPORT.

An inclosed brake staff support, designed to take the place of the ordinary brackets and pawls secured to the woodwork of the car, is shown in the accompanying illustration, and has been patented by Mr. Daniel C. Meeker, of Limestone, Cattaraugus County, N. Y. Fig. 1 is a perspective view of the device, which is shown in section in Fig. 2, Fig. 3 showing its application on a car. A bed plate is arranged for connection with a car roof, or the plate of a box car, this plate being formed with a partial housing and provided with a swinging section, which is a complement of the housing made integral with the bed plate. The upper end of the brake staff is guided by the bed plate, to which

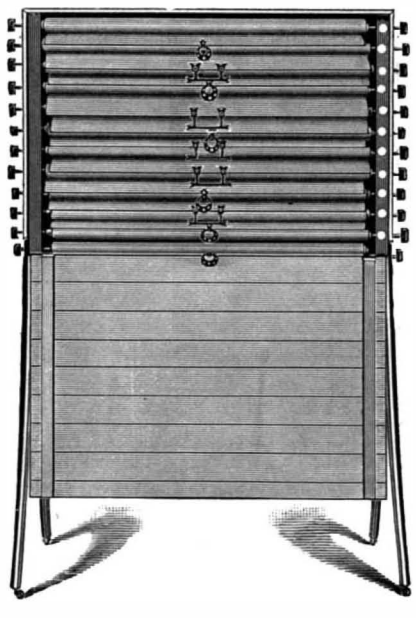


MEEKER'S BRAKE STAFF SUPPORT.

the pawl is pivotally connected, its foot piece extending out over the casting. Both the latter and the housing section are preferably made of malleable iron. This construction is designed to insure a proper holding of the pawl and ratchet, and prevent the entrance of snow, hail, dirt, or any matter which would be likely to clog and prevent their operation.

AN IMPROVED WINDOW SHADE EXHIBITOR.

The accompanying illustration represents a convenient portable device to receive and support a number of curtains or window shades, permitting the ready display of one or more of them at the same time, while the display samples will be securely housed when not on exhibition. The invention has been patented by Mr. Edwin McManus, of Randolph, N. Y. The upper and main portion of the exhibitor consists of a rectangular frame made of two upright end boards spaced apart by top and bottom pieces, while the open sides of the frame are closed by opposite doors hinged to the bottom piece to hang perpendicularly when open, as shown in the illustration. The frame is mounted on legs having stay braces and provided with casters. In vertical strips or stiles secured to the end boards of the frame elongated thumb screw bolts are inserted at spaced intervals, bracket blocks being inserted at corre-

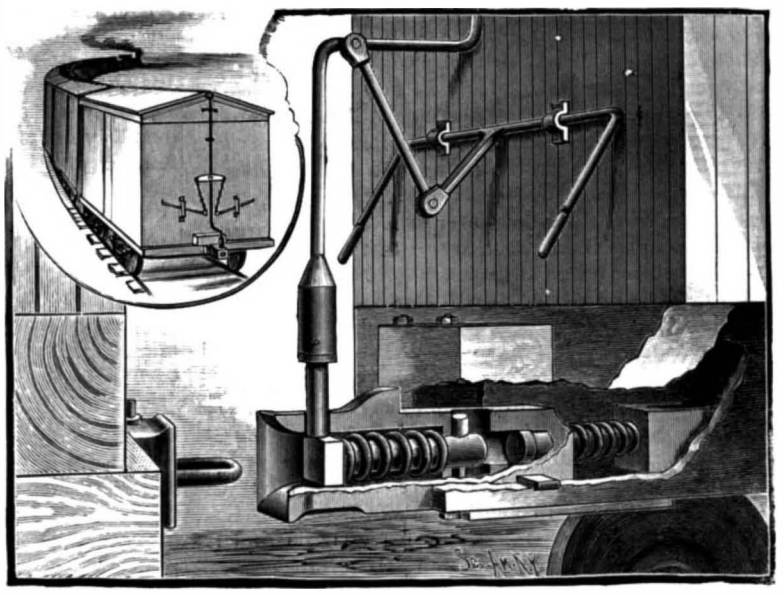


McMANUS' WINDOW SHADE EXHIBITOR.

sponding intervals in the opposite stile, the latter being perforated to receive the pintle ends of rollers designed to support the window shades. The inner ends of the thumb screw bolts are axially perforated to retain in horizontal parallel planes the several rollers, which are provided with the usual springs to automatically roll up the attached shades. There are two series of spaced rollers, one at each side of the frame, near the doors, and when either door is let down, two or three samples of shades may be readily drawn out for exhibition, and others drawn out to overlap them, all being automatically returned to their places when the examination is completed.

AN IMPROVED CAR COUPLING.

A car coupling designed to be simple and durable in construction, and very effective and automatic in operation, is shown in the accompanying illustration, and has been patented by Messrs. Robert L. Finley and Henry H. Harper, of Bonham, Texas. The usual opening in the drawhead continues rearward into an opening in which slides longitudinally a block having its front end concave, to conveniently adapt itself to the end of the coupling link. This block supports the coupling pin previous to coupling the cars, and to its rear end is secured a backwardly extending rod, fitted to slide in the drawhead. On this rod is a coiled spring, and a pin secured in the rod has projecting ends extending into slots in the top and bottom of the drawhead, to limit the inward and outward movement of the rod and the block secured thereto. A key limits the forward and backward movement of the drawhead, the rear end of which is guided on a pin on which is a coiled spring. When the cars are to be coupled, the pin is raised and rests on the top of the block, as shown in the large view, the block being forced outward by the coiled spring on its attached rod, and the coupling pin in the other car engaging the link in the usual way. When the cars come together the block is pushed back, compressing the spring and permitting the pin to drop. Two devices are shown for raising the pin, one view showing the pin connected to an upwardly extending rod, with a handle on its upper end to be operated from the top of the car, and pivotally connected by a link with an arm formed on a longitudinal shaft turning in suitable bearings on the end of the car. On each end of the longitudinal shaft a handle hangs downward, whereby the link may be raised from either side of the car. In the other device shown, a transverse bar is secured to the upwardly extending rod, the ends of the bar being pivotally connected by links with the inner ends of levers fulcrumed on the end of the car, and extending in opposite directions, so as to be within easy reach of the trainmen on either side. By either of these means the coupling pin may be readily raised until the block in the rear of the link is forced outward by the spring, when the pin rests on the block, as shown.



HARPER & FINLEY'S CAR COUPLING.

Tannin in the Treatment of Burns.

A correspondent of the *Pharmaceutische Zeitung*, speaking from his own experience, says that tannin cannot be too highly recommended as an application to burns, especially when very extensive, the skin being entirely removed. A 5 per cent solution is squeezed from a sponge over the denuded surface, which is then dressed with some soft ointment, either with or without tannin. Pain immediately abates, and the healing process is wonderfully rapid. The tannin solution must, of course, be freshly applied as often as the dressings are renewed.—*Drug. Circular.*

AN IMPROVED BUTTER WORKER.

The accompanying illustration represents a machine in which the butter may be worked as taken from the churn, the position of the butter being automatically shifted while a rolling pressure is brought to bear upon it. The invention has been patented by Miss Alma A. Foster, of Pomeroy, Ohio. The trough is essentially triangular in general contour, although curved at the outer or wider end and straight at the inner end. This trough is supported to extend outward from a frame supported by four uprights, the trough inclining slightly downward to the rear, where there is a faucet by which any liquid worked out of the butter may be drawn off. The main front portion of the trough has a central rigidly attached floor section, on each side of which is a wing section, each adapted to be brought to a perpendicular or inclined position relative to the central floor section, this operation being effected by means of chains attached to brackets operated by rods or levers connected with the gearing at the rear of the machine, the operation being automatically effected as the machine is worked to keep the butter constantly in position to be worked by the central roller. The roller is tapering and preferably corrugated or ribbed, and is held to roll from side to side in the trough, by means of a mechanism connected with that which operates the wings, the detail of which is partly shown in the small views, the whole being operated by a crank arm By this means, as the butter is rolled upon the central floor section, by the movement of the roller to one side, it is again returned to position, by the movement of one of the side wings, to be again rolled the other way in the backward motion of the roller, and this movement is continuous until the operation is completed. The trough may be readily removed at any time for cleaning or other purpose.

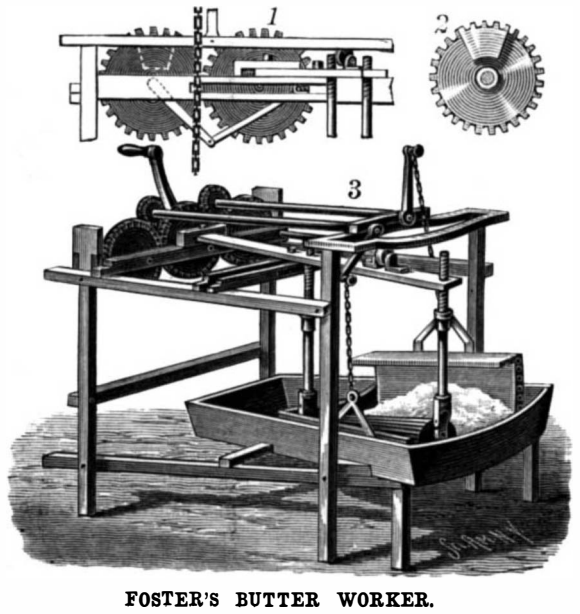
The American Metrological Society.

This society, founded in the year 1873, has for its object the improvement of existing systems of weights, measures, and money, and is largely committed to the metric or decimal system of measures. Its constitution very clearly defines its scope and specifically states that its object is to secure the use of the decimal system. But beyond this limited scope its operations include the securing of common units of measures for physical work and purposes of general investigation. The objects of the society are worthy of all commendation, and their modes of operation, as disclosed in the constitution, include appeals to legislative bodies, boards of education, school teachers, boards of trade, and the like, as well as direct appeals to the people, who eventually must be the arbiters in the matter. The following are the principal officers elected for the year 1890: The president is B. A. Gould, Cambridge, Mass.; corresponding secretary, O. H. Tittmann Washington, D. C.

AN IMPROVED CHECK HOOK FOR HARNESS.

A check hook attachment consisting of a retaining plate adapted to engage the point and close the entrance to the hook, while it is designed to receive the back band strap, which serves to normally hold the plate in position, is shown in the illustration herewith, and has been patented by Mr. George E. Foster, of Santa Ana, Cal. The hook is shown applied to the tree and saddle, the latter being slotted and the upright part of the retaining plate passed up through it. The retaining plate is angular, and its upright part, when the lower portion is in horizontal position, closes the entrance to the hook, but when the lower portion is tipped downward the hook is released, permitting free entrance or exit for the check rein. In adapting the device to draught harness the hook is formed with a slot or loop which receives the retaining plate. The plate is held in place in the hook and saddle by a small screw.

FOSTER'S CHECK HOOK FOR HARNESS.



FOSTER'S BUTTER WORKER.

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Irrigation in the West.

Major J. W. Powell, the director of the United States Geological Survey, contributes an article to the March *Century* on "The Irrigable Lands of the Arid Region," from which we quote the following:

"The Snake or Shoshone River heads in the great forest-clad mountains of Wyoming and runs across the line into Idaho, then passes quite across the Territory until it becomes the boundary line between Idaho and Oregon. Passing the northeastern corner of the last-mentioned State, it enters the State of Washington, and runs westward for a long reach until it debouches into the Columbia. The Shoshone River is one of great volume, second only to the Colorado. Reservoir sites along its course in Wyoming and Idaho have already been revealed by the surveys, and it is shown that in the upper region water can be stored to an amount of more than 2,000,000 acre feet. This will irrigate at the first usage at least 2,000,000 acres of land; and if they be properly selected, so that the waters can be collected again and again after serving the land, the area redeemed will be more than 4,000,000 acres. There are many other tributaries below that have not yet been examined, and it is safe to say that the waters of the Shoshone with its tributaries may ultimately serve from 8,000,000 to 10,000,000 acres. In its utilization three clases of problems are involved. If the waters are taken out in small canals near to the river, and the lowlands served first, and prior rights and interests established on such lands, then but a small part of the stream can be used, and the greater part will run away to the Pacific Ocean; and subsequently the region of irrigation can be enlarged only by buying out vested water rights scattered along the course of the river. But if at the very beginning the water can be taken out high up the river and carried in great canals to either side and there distributed to the higher lands, and used over and over again on its return, a complete utilization can be secured, and the cost of the construction of the system of irrigation by reservoirs and canals will be greatly reduced per acre. To irrigate 2,000,000 acres of land near to the river by short canals taken out along its course here and there will cost more than half as much as the construction of hydraulic works that will serve from 6,000,000 to 8,000,000; while the scattered minor works will be forever subject to destruction by the floods, and the agriculture secured will be of less value per acre, because the best lands will not be served, and only imperfect drainage will be secured."

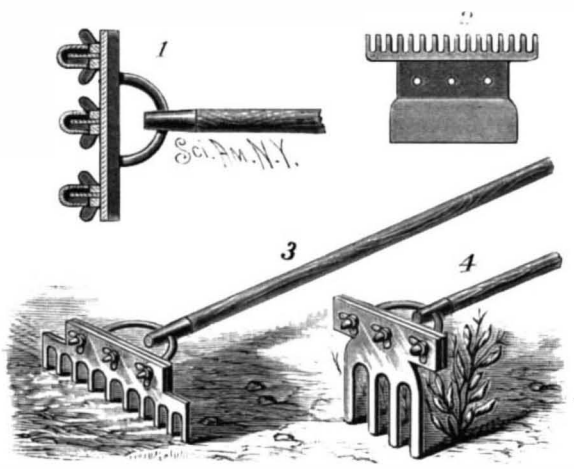
AN IMPROVED MACHINE FOR STACKING HAY, ENSILAGE, ETC.

The accompanying illustration represents a portable stacker, capable of automatic elevation as the stack is formed, and designed for convenient manipulation, while expeditiously forming the stack. It has been patented by Mr. Daniel H. Talbot, of Sioux City, Iowa. The drum of the machine is conical, and may be made of a series of graduated rings or disks tied together so that they may be detached when desirable, or of a series of strips essentially triangular in cross section, provided with a longitudinally tapering outer cylindrical surface. The drum has a trunnion at its reduced end, terminating in a cap, to retain in position a loose sleeve having on its under face an outwardly projecting arm, with an opening through which passes the perpendicular bar or post around which the stack is formed, this bar forming the pivot around which the machine travels. The frame is made with two downwardly inclined side beams, attached at their inner ends to a cross bar, and united at their outer ends by a larger cross bar or beam, making the frame essentially triangular. Upon this frame, above the conical drum, is an inclined platform, upon which the hay-elevating mechanism may be placed and from which the material is fed in the track of the drum. A shield is attached to the forward end of the frame to protect the journal end of the drum from contact with the material to be stacked. A vertically adjustable auxiliary frame is attached to the main frame at one side to release the bearing of the drum from the load carried by the platform, this auxiliary frame usually consisting of two upright side pieces, with a series of apertures, the uprights passing through straps secured to the main frame, and being secured thereto by a bolt or pin. On the lower end of the uprights is a horizontal sill, so fastened that it may be vertically inclined, casters being secured to the sill. The machine is ordinarily operated with a team attached to a vertical beam adjustably fastened to the rear or outer end of the main frame.

TALBOT'S MACHINE FOR STACKING HAY, ENSILAGE, ETC.

AN IMPROVED HOE OR RAKE.

The accompanying illustration represents an improved implement in which the blades are secured by bolts to the handle to form a variety of tools for farm, garden, and plantation use. The invention has been patented by Mr. William Voltz, of No. 189 Chicago Avenue, Chicago, Ill. Fig. 1 represents the handle of the implement, and Fig. 2 a double tool blade, as a combined hoe and rake, for attachment thereto, Fig. 3 showing a rake, and Fig. 4 a potato fork, attached to the handle. Except when used as a double tool, the plate on which the hoe or rake is formed has L-shaped slots to receive the bolts secured on the plate fastened on the lower end of the handle, the tool blade plate being then passed to place through the slots and locked in position by nuts screwed on the bolts. These nuts are preferably arranged with a cap, into which passes the outer end of the bolt, which is then hidden from view, and grass and weeds are prevented from twisting around the bolts. In the central plate of the double tool, as shown in Fig. 2, the bolt holes are simply suitable circular apertures, and in attaching this tool to the handle, the nuts must first be entirely unscrewed from the bolts.



VOLTZ' HOE OR RAKE.

Controlling the Phonograph and Graphophone.

It was announced last week in New York that a syndicate, composed of several prominent capitalists, among them Henry G. Marquand, D. O. Mills, Jesse Seligman, and J. M. Waterbury, of New York, and John Wanamaker and Thomas Dolan, of Philadelphia, had purchased the foreign graphophone patents for $50,000 cash. Inquiry elicited the fact that arrangements had been perfected with Mr. Edison by which a new company is being formed to control both machines in all countries outside of the United States and Canada. One of the Philadelphians comprising the syndicate said: "There has been such a syndicate formed, and those who comprise the syndicate are: D. O. Mills, H. G. Marquand, H. H. Cook, W. Martin Grinnell, Jesse Seligman, and J. M. Waterbury, of New York, and Thomas Cochran, William Wood, George H. McFadden, Thomas B. Wanamaker, and Thomas Dolan, of Philadelphia. John Wanamaker, the Postmaster-General, is not in the syndicate. The company will have possession of all machines and instruments under the patents, and the capital backing the syndicate is unlimited. The particulars will be developed in a few days."—*The Electric World.*

The Difference between Coke and Charcoal.

Dr. W. Thoerner, in an article published in *Stahl und Eisen*, gives the result of a series of experiments designed to bring out the comparative characters of coke and charcoal. He points out that charcoal consists of a large number of more or less regularly arranged cells, joined to one another longitudinally. The walls of the cells are easily permeable by gases, and readily oxidizable. Coke, on the contrary, contains generally separate unconnected cells or groups of cells, the walls of which are composed of a dense vitreous substance which is impermeable by gases and exceedingly difficult to oxidize. Coke acts differently to charcoal in the furnace, and less advantageously because of these differences. If, therefore, it were possible to cause the structure and character of coke to more nearly resemble charcoal, either by rendering it more porous without sacrificing strength, or by making it more easily oxidizable, the coke would be greatly improved. Dr. Thoerner gives the results of several analyses, from which it seems that ordinary gas coke possesses lower real and apparent specific gravity than oven coke, and shows more cell space in its substance. Wood charcoal possesses thrice the purity of coke, with much lower specific gravity and sometimes double the cell space. Pine charcoal, the most porous of all, possesses the densest charcoal substance. In charcoal, the smallest details of the original structure of the wood are preserved; the arrangement of the cells being such that the gaseous products of carbonization can easily escape without rupturing the substance. Consequently, when the charcoal is burnt, the entrance and circulation of oxygen in the cells is equally easy. The charcoal substance does not pass through a stage of fusion in the carbonizing process; whereas in coke the substance has been fused into a dense, impenetrable, vitreous mass through which, in consequence of the want of continuity between the cells, the oxygen can only slowly penetrate.

Natural Gas at Anderson, Ind.

At the recent annual meeting of the Citizens' Gas Company, of Anderson, Ind., president John L. Forkner made an interesting report, from which we extract the following:

We have laid 17,000 feet of additional mains, completed a high pressure line through the entire system, making a complete circuit, from which we feed the low pressure mains, at such points as it is necessary to give perfect service.

The mains of the Citizens' Gas Company now extend throughout the entire city of Anderson proper. They are furnishing fuel to the whole populace, with but few exceptions. We undoubtedly have the best system and the most complete plant in the Indiana gas field.

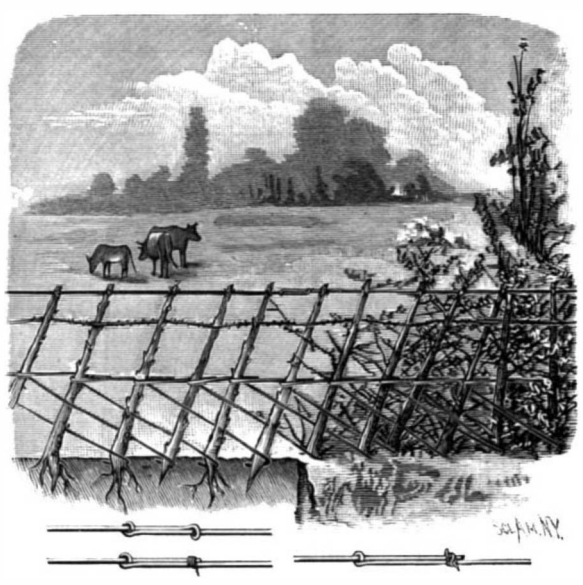
We have now four first-class gas wells, giving an output of from 20,000,000 feet to 30,000,000 feet of gas per day. The plant is in a splendid condition.

Not an accident to person or property has happened during the past year, and but one small break has occurred in the lines, and that was of minor consequence, and soon repaired.

The splendid system of free fuel, inaugurated by our company, has attracted many people to our prosperous and growing city, who are buying and building homes among us, that they may enjoy the luxury of natural fuel.

AN IMPROVED HEDGE FENCE.

The accompanying illustration represents a method of constructing a hedge fence by plashing in a systematic way, connecting the upper ends of the canes by a horizontal rod or rail formed in sections, and having spliced connections with each other. The invention has been patented by Mr. Peter Geiser, of Waynesborough, Pa. The trimmed-out canes or stalks are drawn to their desired inclined position, and thus held by a series of wire bracing strands with open-ended hooks on one end to embrace the roots, slightly under the surface of the ground, the wires passing diagonally upward to be bent around certain of the canes and passed horizontally backward, where they are interlapped without fastening on opposite sides of adjacent canes. To stiffen the top line of the canes a horizontal railing or strand is passed or plashed through between and with them, this line being made up in sections with splicing loops, as shown at the bottom of the engraving. The top ends of each of the canes are preferably tied to this railing with tarred or other waterproof cords or wire. Below this line may be used one or more horizontal strands of barbed wire, which are simply passed between and alternately on opposite sides of the canes, without fastening them otherwise than by their contact with the protruding stubs or thorns.



GEISER'S PLASHED HEDGE FENCE.

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THE NEW BOSTON FIRE BOAT "ENGINE NO. 31."

The city of Boston has recently built and put into service a fire boat, designed for use as a floating fire engine. As the vessel in question represents the most advanced type of fire boat, and in a number of points differs from any hitherto constructed, we illustrate it in this issue. The construction of boats of this kind has now been developed until they are no longer mere tug boats with special pumps. Everything in their design is intended to insure the production of a true floating fire engine, one that for days in succession, without a minute's intermission, can throw water upon burning buildings or shipping. Thus on the occasion of the burning of the great elevators of the New York Central Railroad in this city, in May, 1889, the New York Fire Department boat Havemeyer was kept at work for nineteen days and nights, her boiler being under forced draught for that period. This, of course, was a highly exceptional occurrence. There are but few structures in New York and its environs that would require such heroic treatment if burning. Yet it shows what a fire boat may be called on to perform.

The new Boston fire boat is named "Engine No. 31," and has no other title. The general dimensions are as follows: Length over all, 108 feet; on water line, 97 feet; beam, maximum, 24½ feet; on water line, 23 feet; depth of hold, 8 feet 1 inch; draught, 7 feet 4 inches. The hull is of wood, and is of extra strength to resist the exceptionally heavy strains to which the heavy machinery will subject it. The best quality of white oak is used for the principal members of the frame and for the planking. Hackmatack and yellow pine are used for upper frames and other parts. Below the water line the hull is sheathed with yellow metal.

The stem under the water curves upward very gradually from the keel, and from a point about two feet above the water line downward and aft for about twenty feet carries a yellow metal shoe, one-half inch thick. On the hurricane deck, or above the main deck house, is the pilot house and the officers' house and drying room. The cabins in the main deck house include officers' cabin and main cabin, galley, mess room, and general offices. Accommodations for a crew of fourteen men and officers are provided in this house.

The steam is generated by Cowles' water tube boilers. There are two of these, each occupying an area of 11½ × 7⅓ feet, and in height rising 11½ feet. When filled with water and ready for use the two weigh 19·74 tons. They have 3,200 square feet of heating surface, a little over 87 square feet of grate surface, and are tested up to 300 pounds, giving a working allowance of 200 pounds. With natural draught they develop 400 horse power, which may, by steam jets in the chimney, be brought up to 900 horse power. This boiler is a sort of combination tube and shell boiler. The tube ends are expanded into place, so that no screw connections are exposed to the fire. The same type of boiler is used upon the New York fire boat Havemeyer.

The engine is two-cylinder compound, 18 and 34 inch cylinders, with 20 inch stroke. They are inverted, and are carried on six wrought iron columns. They have link gear, and in general are of the tug boat type. A Wheeler surface condenser of 1,000 square feet surface is employed to condense the exhaust steam. The shaft is of wrought iron and steel, and is 6¾ inches diameter at its smallest part. Steam reversing gear is used.

Two screws are used, embodying the Kunstadter steering gear arrangement. One works just aft of the stern post and forward of the rudder, in the usual place. The other, termed the swiveling screw, is carried by a short shaft journaled in the rudder, and revolves about this as an axis, the rudder being cut away to allow it to rotate. This short shaft is connected to the main shaft by a universal joint directly in line with the rudder post, which is cut away to allow room for it to work in. As the rudder turns, it turns the axis of the after screw, so as to materially reenforce the directive action of the rudder. The rudder is of cast steel. The front screw is of 6 ft. diameter and 9 ft. pitch; the after or swiveling screw is of the same diameter, but of 10 ft. pitch. Each has four cast steel blades. When the rudder is straight, the thrust of both screws comes upon the inboard thrust bearings; when the rudder is inclined, the oblique component of the thrust of the after screw is taken by the rudder frame.

A steam steering engine, double cylinder, 7 in. stroke, 5 in. diameter, is employed to turn the rudder and the swiveling screw. A small steering wheel in the pilot house is used for working it. Spare tackle is provided for steering by tiller when necessary.

The pumps were built by the Clapp & Jones Manufacturing Company, of Hudson, N. Y. They are of vertical, duplex, double-acting flywheel type. They are divided into two sets, comprising altogether 4 steam cylinders, 10 in. by 10 in., and 4 water cylinders of 10 in. stroke and 9 in. diameter. One set is placed on each side of the engine room. In the forward end of the deck house is a cast iron 12 inch header, into which the pumps force their discharge. It has four 3½ in. and four 2½ in. hose connections, with gates or valves. To these hose of any length may be connected, so that water can be delivered at high pressure, one or two thousand feet away. Upon the forward deck are also installed two Cowles swiveled nozzles carried by short stand pipes. Each of these delivers a four inch stream of water. They can swing through a complete circle, and can be elevated 60 degrees. A 9½ in. copper pipe is carried from the pumps below deck on the port side, to supply the header and stand pipes. The means for perfectly controlling these immense streams are well illustrated in the cut. The maximum working pressure is 225 lb. On the trials this pressure was not attained. The pumps could be driven up to 320 and 330 revolutions per minute. At 300 revolutions, with 50 to 60 lb. pressure, they worked well. A good working speed was found to be 210 revolutions and 140 lb. pressure. They threw a 4 in. stream from the Cowles nozzle about 400 ft. and four 2⅝ streams 230 ft. through 100 ft. of 3¼ in. hose and hand pipes simultaneously.

On her trial trips the boat was found to be of good speed, developing a speed of 16 2-7 statute miles per hour. The swiveling screw on this speed test showed a slip of only 4·7 per cent, and the leading or stationary screw showed a negative slip, due undoubtedly to the boat drawing water after it. A considerable slip is not incompatible with efficiency, and the old view that the two could not coexist has been abandoned.

The fire pumps were found to be unexceptionable in their working. In the illustration a good idea is given of the service that such a boat can perform. In addition to the two four-inch streams thrown from her forward deck under perfect control, a number of lines of hose can be carried from the header, so as to deliver water to engines on shore. Thus the boat is not merely for the protection of the water front. Most useful service can be executed in a belt 2,000 feet wide around the shore line.

High speed is a valuable factor in boats of this character, as enabling the nearest point to a conflagration to be quickly reached. This is possessed by "Engine 31." The Kunstadter screw steering attachment increases the maneuvering powers greatly. A positive and efficient steering can be obtained when the engines are reversed, so that the boat can be worked to a certain extent as a double ender. This quality of good steering when going backward might be of the utmost importance in critical positions.

Recent Additions to the British Navy.

The following is a list of the vessels launched for her Majesty's navy during the past year:

Name.	Tons.	Horse power.	Speed.	Cost.
			knots.	£
Blake	9,000	20,000	22	430,653
Vulcan	6,620	12,000	20	292,107
Barham	1,830	6,000	19·5	101,408
Blanche	1,580	3,000	16·5	96,937
Blonde	1,580	3,000	16·5	96,937
Barrosa	1,580	3,000	16·5	96,937
Barracouta	1,580	3,000	16·5	96,937
Basilisk	1,170	2,000	14·5	67,632
Beagle	1,170	2,000	14·5	67,632
Widgeon	805	1,200	13·5	45,678
Redpole	805	1,200	13·5	45,678
Goldfinch	805	1,200	13·5	45,678
Lapwing	805	1,200	13·5	45,678
Ringdove	805	1,200	13·5	45,678
Magpie	805	1,200	13·5	45,678
Redbreast	805	1,200	13·5	45,678
Sparrow	805	1,200	13·5	45,678
Thrush	805	1,200	13·5	45,678
Wizard	735	4,500	21	58,000
Whiting	735	4,500	21	58,000
Salamander	735	4,500	21	58,000
Seagull	735	4,500	21	58,000
Sheldrake	735	4,500	21	58,000
Skipjack	735	4,500	21	58,000
Spanker	735	4,500	21	58,000
Speedwell	735	4,500	21	58,000

To these may be added thirteen first class and ten second class torpedo boats, supplied by Thornycroft, Yarrow, White, and a Paisley firm, for the navy, and the Pandora and four sisters, of 2,575 tons and nineteen knots speed, for Australia.

Maria Mitchell Chair of Astronomy.

But a few months have elapsed since we had to record the death of Maria Mitchell, the professor of astronomy at Vassar College. One of the last efforts of her life of usefulness and of devotion to education and science was in the direction of making the astronomical department of Vassar College self-sustaining. Only her failing health and death prevented the accomplishment of her wish. By personal solicitation she had raised $5,000, no inconsiderable nucleus, as has since been made evident. Already the alumnæ have increased the sum to over $25,000, leaving about $15,000 still to be raised. The establishment of a professional chair requires about $40,000. Miss Mitchell did much to advance her chosen science, and played her part in elevating the standing of her college and country in the astronomical world. Some testimonial is due to the bright Nantucket lady who was a friendly rival to Mrs. Huggins in her devotion to stellar science. Our readers know her as a most interesting contributor. We feel that many of Prof. Mitchell's scientific friends will be only too glad to have an opportunity of contributing to a testimonial in her honor. Such an occasion has now offered itself, and will, we trust, be liberally responded to by many. Subscriptions may be addressed to Vassar College, Poughkeepsie, N. Y.

Correspondence.

Warts—their Cure and Removal.

To the Editor of the Scientific American:

In reading the SCIENTIFIC AMERICAN of February 8 I found a remedy for removing warts. I send you a remedy that we have found to be better and more simple. Take common washing soda and make a very strong solution. Apply it to the wart four or five times a day. We have tried this and have never seen one wart that this would not remove in a few days and leave no soreness at all. A. J. MOSLEY & SONS.

West Philadelphia, Pa.

Destroy the Sparrows.

To the Editor of the Scientific American:

I am compelled to take exception to the answer in No. 1826, to "C. McE.," wherein it is suggested the English sparrow is useful in destroying worms.

The English sparrow is a granivorous and not a carnivorous or insectivorous bird, and will not touch an insect. The country to-day is as much, if not more, infested with injurious insects than before the sparrow made its appearance, and that is owing greatly to the fact that the English sparrow is an enemy to and has driven most of our native birds away, which were insect-eating and did much toward ridding the country of the pests. The little wren, one of the most valuable insect-eating birds, has got to be quite a curiosity on account of its scarcity, being run out by *boss* sparrow. It is a fact that the sparrow has become a nuisance in every respect, and should be exterminated.

The habits of birds has been a life study with me, and I speak from experience. THOS. D. HYATT.

49 Bainbridge St., Brooklyn, Feb. 15, 1890.

A Striking Hypnotic Experiment.

The end I have ever held before my eyes, then, and which I hope I have never lost from view, is this: to study the hypnotic phenomena according to a strictly scientific method, and for this purpose to employ processes purely physical and which can always be compared with one another, so that the results obtained by me may be rigorously tested by all observers who shall use the same processes under the same conditions.

Take one example from among a thousand. I present to a woman patient in the hypnotic state a blank leaf of paper, and say to her: "Here is my portrait; what do you think of it? Is it a good likeness?" After a moment's hesitation, she answers: "Yes, indeed, your photograph; will you give it to me?" To impress deeply in the mind of the subject this imaginary portrait, I point with my finger toward one of the four sides of the square leaf of paper, and tell her that my profile looks in that direction; I describe my clothing. The image being now fixed in her mind, I take that leaf of paper and mix it with a score of other leaves precisely like it. I then hand the whole pack to the patient, bidding her to go over them and let me know whether she finds among these anything she has seen before. She begins to look at the leaves one after another, and as soon as her eyes fall upon the one first shown to her (I had made upon it a mark that she could not discern), forthwith she exclaims: "Look, your portrait!" What is more curious still, if I turn the leaf upside down, as soon as her eyes rest upon it, she turns it over, saying that my photograph is on the obverse. I then convey to her the order that she shall continue to see the portrait on the blank paper, even after the hypnosis has passed. Then I awaken her and again hand to her the pack of papers, requesting her to look over them. She handles them just as before when she was hypnotized, and utters the same exclamation: "Look, your portrait!" If now I tell her that she may retire, she returns to her dormitory, and her first care will be to show to her companions the photograph I have given her. Of course, her companions, not having received the suggestion, will see only a blank leaf of paper without any trace whatever of a portrait, and will laugh at our subject and treat her as a visionary. Furthermore, this suggestion, this hallucination, will, if I wish, continue several days; all I have to do is to express the wish to the patient before awakening her.

The foregoing experiment has been made hundreds of times by me and by others, and the fact can easily be substantiated; their objectivity is as complete as could be wished in researches of this kind. Hypnotism is directly amenable to our means of investigation, and must needs be an integral part of the known domain of science; to that goal our efforts ought to be directed.—*Dr. J. M. Charcot, in the Forum.*

Hair Invigorator.

A correspondent of the *Lancet* states that he has found the following preparation most useful in cases of falling off of the hair:

Tincture of jaborandi	½ oz.
Lanoline	3 drachms.
Glycerine	2 oz.

Mix [by the aid of a little soft soap].

A little to be rubbed in every night.

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What Sanitary Reform can do for a City.

The Secretary of the Tennessee State Board of Health, Dr. J. Berrien Lindsley, has prepared an article for the forthcoming report of the board which shows in a striking manner how the health of a large community can be benefited by the intelligent efforts of a few active individuals who have the support of public opinion. The article deserves to be studied by sanitarians everywhere, if only as an encouragement to them to persevere in their apparently thankless task, often against great odds.

Dr. Lindsley's paper is a history in brief of the work of sanitary reform in the city of Nashville, which work was begun in 1874, the immediate incentive thereto being the devastation wrought by the last cholera visitation.

"The Board of Health, as organized in Nashville, consisted of the mayor, *ex officio*, and of four physicians, chosen by the City Council, with a medical health officer exclusively devoted to the work. The city was then small and very poor. Hence the board moved cautiously. No extravagant system of sanitary engineering was urged, no bonds issued, no debt incurred. The first steps were the registration of deaths and thorough local sanitation. Rigid house-to-house inspection by first-class officers was steadily pursued. Health ordinances impartially and uniformly enforced. A complete sanitary survey of Nashville was taken early in 1877, a thing which had not at that time been attempted in a Southern city, and, indeed, in only one or two in America. Its value can hardly be computed. Besides giving that information without which a board of health moves in darkness, it is an educator without equal. An intelligent and respected member of the police force, well known and well liked by all the community, visited every house and every building in detail. With suitable memorandum books, he entered the results of his inquiries. Thus, in a few months, every one in Nashville was initiated into the work undertaken by the board—that of making Nashville a city renowned for health and proof against epidemic scourges."

During the epidemic of yellow fever in Western Tennessee, in 1878, Nashville became a veritable city of refuge, and its board of health had an opportunity to demonstrate the efficiency of individual isolation and perfect sanitary preparation. The healthfulness of the city at this time was so universally ascribed to the efforts of the board of health, that the citizens gave them an ovation as a mark of gratitude and public appreciation of their services. This public demonstration was, of course, of far reaching benefit in impressing upon the entire community the undoubted value of sanitary reform.

In the fall of 1883 the Board of Public Works came into existence, and at once began the work of remedying the great defects made apparent by the sanitary survey. These were, especially, the deficient water supply, the almost total lack of drainage, the miserable condition of the alleys, and the pressing need of improved streets and sidewalks in many portions of the city. The progress made in each of these lines has been progressive and most satisfactory. The city has now twenty-five miles of sewers, and the new water-works, nearly completed, will furnish a daily supply of thirty million gallons.

But of more interest than a mere statement of what has been done in the way of sanitary improvement is a comparison of the results following these improvements. This can be stated in very few words:

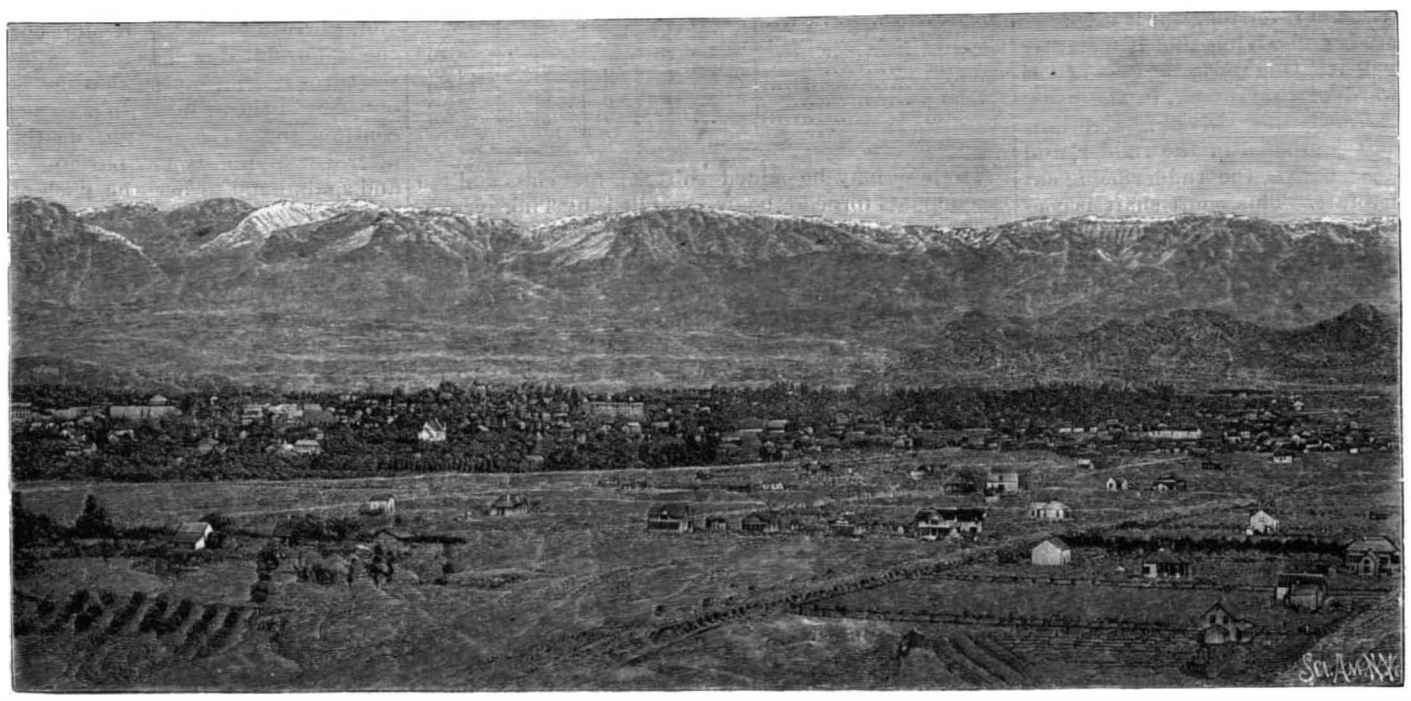
In 1877 Nashville occupied an area of scant three miles, with a population of 27,000, and a death rate of 34·55 per 1,000 yearly. Now it has an area of 4,021 acres, or six and one-third square miles, with a population of 68,531, and a death rate of 15·31.

As Dr. Lindsley justly says, this is progress. It is true that Nashville is favored by its position, and it would be a disgrace were it not a healthy city; but that should be no cause for discouragement for other less favored localities. Even the city of Mexico, built as it is almost in a swamp, is destined, without doubt, to become one of the healthiest cities in the world when the huge sanitary work now in course of construction is completed. Nashville was not a healthy city before Dr. Lindsley and his associates took hold of it, and it is now what they, and others inspired by their zeal and enthusiasm, have made it; and there is no valid reason why every other city and town in the country should not be improved in the same way, if only the right men can be found to undertake the task. They certainly ought to be urged at least to try, after reading of what Nashville has accomplished quietly and as a result of patient effort.—*Medical Record.*

AN ARTESIAN WELL NEAR RIVERSIDE, CAL.

Failure of Natural Gas at Upper Sandusky, O.

Upper Sandusky's great gas well, known as "Jumbo," has given out, and the town is likely to return to coal. On the 1st of December there were over 1,600 fires going, but of late a large number have had to be shut off on account of the lack of supply, and others have paid their bills and ordered the mixers taken out, expecting to go back to coal or wood. The Ohio Thrasher Company, which was induced to come here from Mansfield, expecting free gas, has already expended about $30,000, and being about ready to commence business find that they will be left out in the cold. The citizens feel very indignant at the managers of the gas company, believing that by proper management they would not thus have been shut off. The entire town has been piped, and nearly every one connected, at costs ranging from $25 to $75, which is about as good as that amount thrown away. Three wells are being put down just north of town, and still some hopes are entertained that gas will be found, but for the present the people will have to be content with carrying wood and coal, as in years gone by.—*Fostoria Democrat.*



RIVERSIDE, CAL., AS SEEN FROM RUBIDEAUX MOUNTAIN.

THE ARTESIAN WELLS OF RIVERSIDE, CAL.

In the February number of last year's *North American Review* Wm. Hosea Ballou, in an article entitled "Unconscious Suicide," refers to the impure sources of supply of the domestic water systems of all the leading cities of the United States, and the enormous increase of mortality proceeding from this cause. There are, he declares, only a few towns, and these small ones, in the whole United States which have a perfectly pure water supply, notably Grand Rapids, Mich., and Waukesha, Wis., "which are fed by enormous springs—cases exceptional and singular in the water works history of this continent."

Mr. Ballou may be excused for having overlooked the domestic water system of Riverside, Cal., from the fact that it had only been in operation about a year when the article we refer to was written. The domestic water system of Riverside (a place of about 7,000 inhabitants), Cal., is supplied from artesian wells, about ten or twelve in number. The discharge from each well is conveyed in open cement conduits to a central reservoir, where, after having been sufficiently aerated, the water is conveyed by a main pipe to Riverside, about ten miles distant, where it is distributed by branch pipes in the usual way.

The artesian basin in which these wells are sunk is situated at the foot of Mounts San Bernardino and Gray Back, of the Sierra Nevada range. Gray Back is 11,500 feet above sea level, and snow can be found on its northern summit every day of the year. It is this melting snow, percolating down through the thousand feet of rocks and sand into the gravel strata, that furnishes the supply where, about seven miles from the base of the mountains, the wells are sunk. This water has been pronounced by Prof. Hilgard, State analytical chemist, who analyzed it, as containing not the slightest trace of any foreign substance, being absolutely pure. It is remarkably clear and sparkling. The artesian wells of this system are all (fourteen) sunk in close proximity to each other within about seven acres of ground. Average depth of wells 122 feet. The source of supply seems practically inexhaustible. As fast as the requirements of the rapidly growing city of Riverside (the orange growing center *par excellence* of California) demand, a new well is sunk. The last one was put down last month, and is now flowing 148 inches, and with such force that it brought up from the bottom and projected from its mouth a stone weighing 2½ pounds.

These wells are situated at an elevation of 174 feet above the lowest part of the city, giving a pressure sufficient for all fire purposes. The surplus water from this system is used for irrigating orange orchards, but must not be confounded with the irrigation water system of Riverside, the supply of which (about 4,000 inches) is carried from the foot of the mountains in an open canal.

E. R. SKELLEY.

Riverside, Cal., February, 1890.

THE sustaining power of the Forth bridge may oe imagined from the statement that each cantilever would sustain six of the greatest ironclads.

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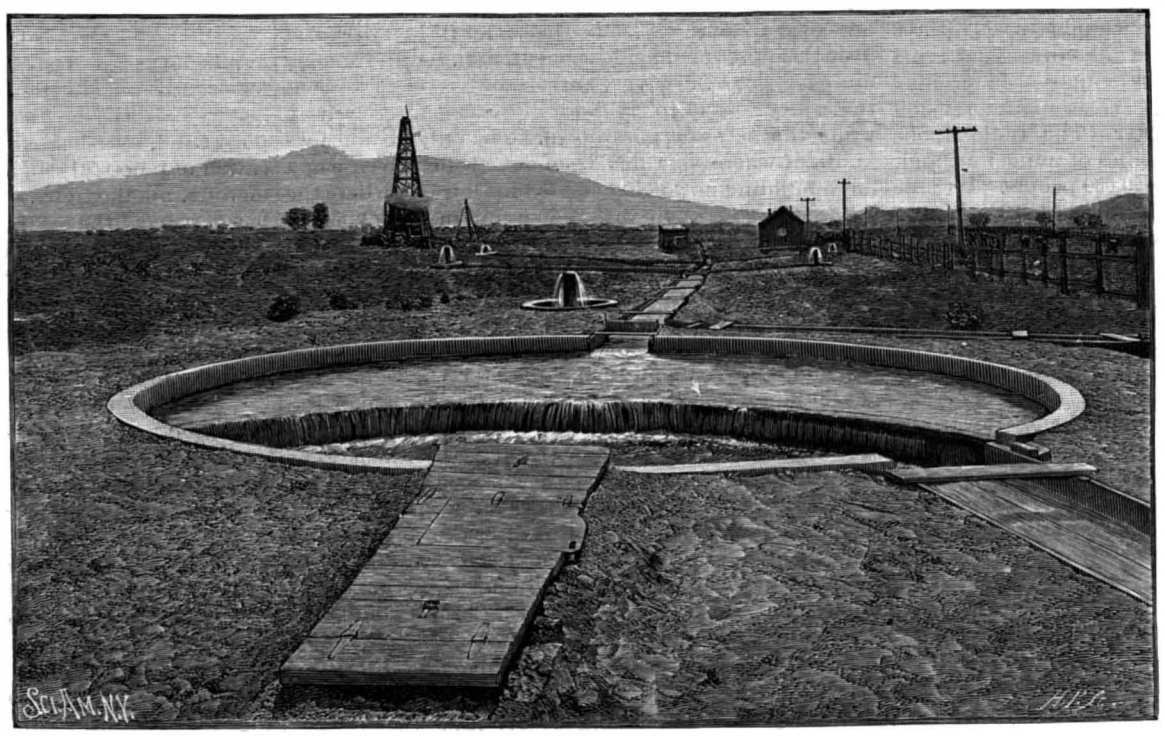
THE ARMADILLO.

Since naturalists have begun to study the animals of earlier ages as diligently as those of the present time, the latter have been forced by comparison to give way to the former; for in the ranks of the extinct fauna are many gigantic forms which cannot be approached by their modern representatives. Apparently many large animals are doomed to extinction; the sea cow, the great auk, and the dodo have died out within historic times, and there is no doubt as to the fate of the elephant and other pachydermata.

The armadillo must be a near relative of those enormous edentates, the glyptodon and the megatherium; but in regard to size it is truly eclipsed by them, for its greatest length is about one yard or one and a half yards. The fossil edentates seem to have resembled the living members of their family closely in their limited mental capacity, and to have used very little intelligence for the preservation of their kind.



ARTESIAN WELLS AND RESERVOIR, RIVERSIDE, CAL.

The three armadilloes shown, like all their class, are clumsy, awkward creatures, with narrow, long-snouted heads, weak eyes, ears like those of swine, short but powerful legs, with strong, curved claws, and a long tail.

The armor differs from the scale covering of other animals, the middle being formed of bands of bones, which is the distinguishing feature of the species. The skeleton shows remarkable development of the fore legs, the thigh bones and claws being of peculiarly strong construction, well adapted for their work.

No. 1 in our illustration represents the ball armadillo (*Dasypus tricinctus*), called by the natives *apar* or *matako*, and by the Spanish, *bolita*.

The artist has shown it rolled up like a hedgehog, a position which only this species of armadillo is capable of assuming. Its length from the point of the snout to the tip of its tail is about seventeen inches; the armor of plates or scales is interrupted by three bands (not visible in the cut); its color is dark gray or brownish. The forefeet have strong, slightly curved claws, on the points of which the animal walks, while the claws of the hind feet lie horizontally on the ground.

Travelers who have seen these animals run describe the movement as very comical, this impression being increased when the bolita runs clattering over boards. Its ability to roll itself up protects the armadillo from the attacks of many animals.

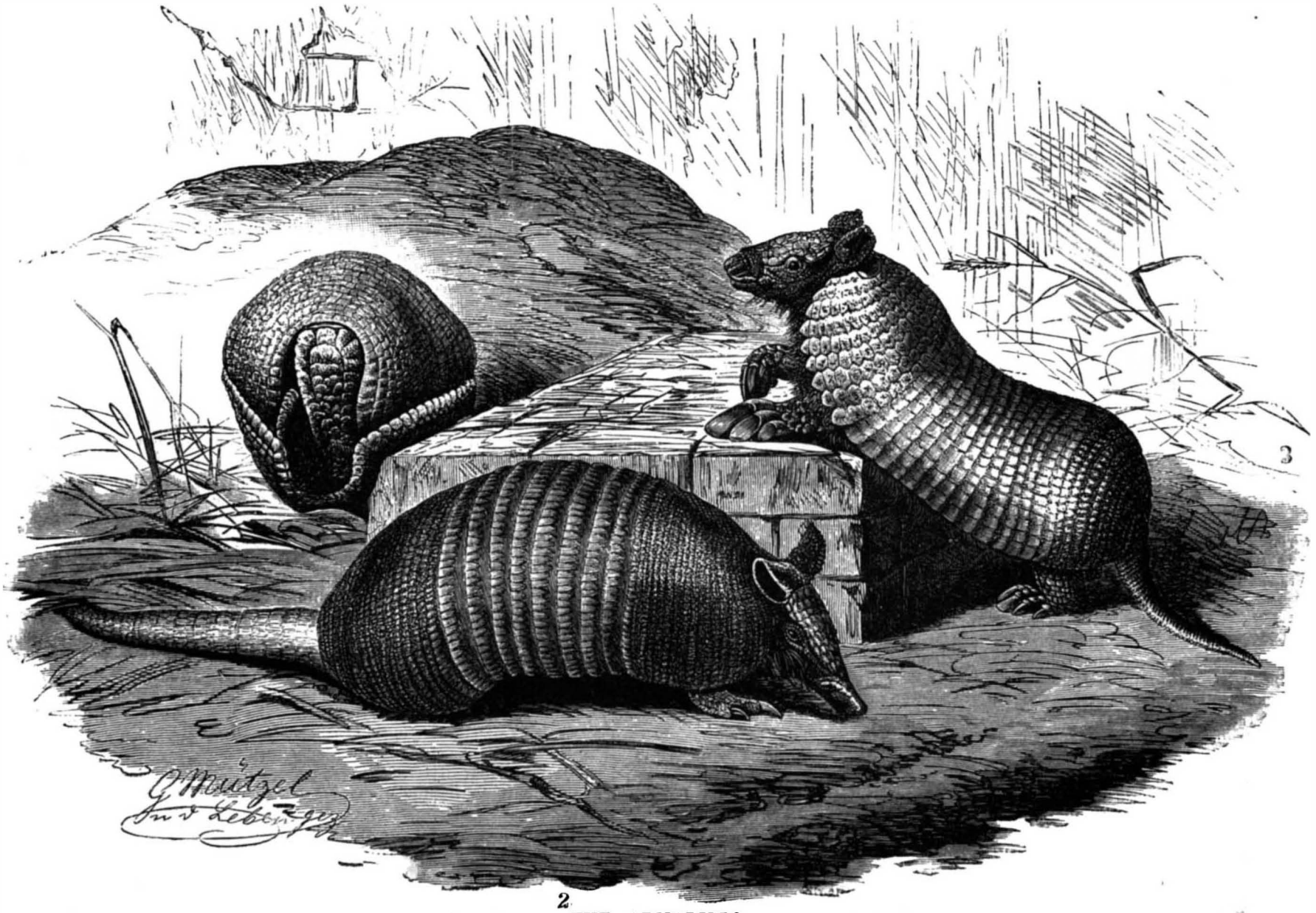
The bolita is found in the great plains of South America, the home of all armadilloes, being most numerous in the Argentine Republic. Captive bolitas eat fruit and leaves, but their food has to be prepared in small pieces, because their mouths are very small.

The tatou (*Tatusia Kappleri*) is marked No. 2 in our illustration. It attains a length of about twenty-three inches; its forefeet are provided with four claws and the hind feet with five, and its armor consists of little four-cornered scales, the separate bands consisting of triangular plates with the points forward.

No. 3, the bare-tailed armadillo (*Dasypus gymnarus*), has a very different armor, the front part of which is provided with divisions resembling the cells of honeycomb. The claws on its forefeet are developed to a remarkable degree, reminding one of those of antediluvian creatures. A full grown tatou can dig a hole longer than itself in three minutes, or in less time if the ground is soft. It is stated that the animal sinks before the observer's eyes, and these statements are proved by the two armadilloes in the Berlin Zoological Garden. As they roll themselves up in their holes, it is almost impossible for even a strong man to draw them out. The armadillo is often obliged to enlarge or change his burrow in his search for food, which consists of beetles, larvæ and worms, ants and termites. Its manner of burrowing reminds one of the mole.

Although the flesh of the armadillo is prized in South America, it is much disliked by the hunters of the broad steppes. The burrows of tatous often throw galloping horses, injuring them or throwing their riders from their saddles.

Besides the armadilloes already referred to, we might mention the *Dasypus yigas*, *Dasypus sexcinctus*, *Dasypus conurus*, *Dasypus minutus*; all of which are natives of South America.—*Illustrirte Zeitung.*



THE ARMADILLO.

The Value of Electric Lighting on the Suez Canal.

The night traffic on the canal has increased very rapidly since electric lighting was started. Thus in 1887 there were in all 371 night transits made, but in 1889 this number had increased to 2,454 out of a total of 3,420, or upward of 71 per cent of the vessels passing through the canal, and four-fifths of the total tonnage, used the electric light to assist them. At the same time the average duration of the passage has been reduced upward of 40 per cent. Putting these facts into another shape, it appears that the effect of the electric light as applied at Suez has been the same as if the canal had been increased from 22 meters, its present width at the bottom, to 32 meters, an operation which would cost at least £4,000,000.

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Natural Gas in Indiana.

A synopsis of Indiana gas facts and figures shows that 400 miles of pipe lines have been completed, including those supplying the city of Indianapolis from the Hamilton County field. Of the Indianapolis lines, the Consumers' Trust, with its recent purchase of the Broad Ripple plant, has about 74 miles of pipe line, and with its 9,000 connections supplies about 35,000 people. Its pipe line includes 30 miles of 8 in., 14 miles of 10 in., 12 miles of 12 in., and 18 miles of 16 in. pipe, and it has about 115 miles of street mains, varying from 16 in. to 3 in. in diameter. The Indianapolis Natural Gas Company has 35 miles of pipe line, and, with 5,000 connections, supplies 20,000 people. Its pipe line includes 6 miles of 6 in., 8 miles of 8 in., and 21 miles of 12 in. pipe, and its street mains extend over 60 miles. The two companies combined supply 55,000 domestic consumers, at a saving over former coal bills of $250,000 annually, and up to a comparatively recent period each supplied about 150 factories and public buildings, with an annual saving over former coal bills of more than $100,000.

The other completed pipe lines in the State vary in length from 5 to 48 miles and in diameter 2 in. to 12 in., the majority of them averaging 8 in. Upward of 20 cities and towns in the State, with an average population of 260,000, are supplied with pipe line service, and if the cities and towns of the State supplied directly from the wells are added, the list will be increased to 71 cities and towns, with an aggregate population of 411,000, in round numbers. Placing the calculation on the basis that one-fourth of the population in cities and towns supplied with natural gas are consumers, it would give the State upward of 100,000 municipal consumers, with an approximate annual saving over former fuel of $3,000,000. The saving to manufacturers in the four cities of Muncie, Anderson, Marion, and Kokomo alone foots up $1,045,000 a year, and if the savings of all the other State manufacturers using gas fuel did not exceed another million, it would make up a total of $5,000,000 a year as the amount of saving effected by the new fuel to the people of the State, saying nothing about the increased comfort and incidental advantages which attend its use.

In piping of natural gas it is estimated that capital has come into the State amounting to $7,433,000, employing 7,783 new operators. Still this does not begin to show the actual benefit in the way of employment and the increase of population to the State. Then it is asserted that "the area supplied with natural gas in Indiana by wells within its boundaries and pipe lines extending from the main field now includes portions of 30 counties, containing a territory that measures more than 8,000 square miles and populated by more than 1,000,000 residents. The main field of supply alone includes the greater portion of 21 counties, containing more than 6,000 square miles and a population of 750,000. As compared with this, the gas fields of other sections of the country seem very limited. This State has less than 400 square miles of productive gas territory. The Ohio field, counting all territory claimed as productive, measures less than 1,200 square miles. The Indiana gas territory already developed will measure several times as much as all the other gas territories thus far developed on this continent.

What the future of the Indiana field will be is to some extent a matter of conjecture, but there is every reason to believe its supply will outlast that of other sections. The big wells in the upper portion of the Indiana belt, like the "Jumbo," at Fairmount, in Grant County, which furnishes 11,500,000 ft. daily, and which has transformed that town into a manufacturing center with a doubled population, show no appreciable diminution of their flow since they were struck, more than two years ago. The safeguards claimed to be thrown about the Indiana natural gas, and which seems likely to preserve a supply for the use of the people of that State long after the supply of its neighbors has been exhausted, is its low initial pressure and geological location of the belt. The latter makes it impossible to convey the gas to points outside the State without the use of extended pipe lines, and the low rock pressure makes it difficult, if not impracticable, to carry the gas in pipe lines beyond a moderate limit.

Damage to Adjoining Structures from Heavy Buildings.

With the increasing size and weight of modern office buildings there come not only serious problems of safe and economical construction, but the still more difficult question of how to prevent damage to adjoining structures, not merely from undermining of foundations, which can be avoided by suitable underpinning, but from the actual compression of the soil.

If any one will take the trouble to examine the old and comparatively light buildings alongside of which some high and heavy structure has recently been erected, the chances are that he will find the old buildings more or less damaged by their new neighbor, and cracked walls and sills, and especially cracked lintels over the nearest windows, will show that the old wall next the more recent structure has been carried bodily downward. As before intimated, this settlement in most cases is not caused by any defect in or injury to the foundation of the old building, but by the fact that the heavier structure has compressed the soil and taken the lighter one down with it.

As the evil is progressive, increasing as the new building goes up, and for some time after it is finished, it cannot be provided against once for all, but the remedy must be progressive also, and the only way to prevent the injury is to keep the old wall wedged or screwed up while the new one goes down. The only instance we know of where this has been done is in the case of a large building now being erected in Chicago, where the soil is so compressible that such a building is expected to settle three or four inches during construction, and where one fine tall building has had one corner carried down four or five inches by a heavier building alongside, with the result of very badly cracking the older structure from top to bottom through the nearest line of windows. To avoid such a disaster the wall of the old building, some seven stories high, next which the new building just mentioned is being put up, is temporarily supported on screws, and is by them kept slightly above its normal position, so as to allow for settlement between times. These screws will support the old wall for some six months after the new building is finished, and until all settlement is over. With a less compressible soil, or a lighter building, perhaps iron counterwedges between stout bearing stones would give sufficient lift, and could be left in when the new building was completed.—*The Engineering and Building Record.*

Beavers—Their Sagacity and Industry.

Probably more has been written about the industry of the honey bee and the sagacity of the beaver than about any other two members of the animal kingdom. A recent number of the Boston *Journal of Commerce* gives a most graphic description of the intelligent and industrious beaver as follows:

Beavers live in families, like human beings. The male has one wife, and the children stay at home until they are three years old, when they go abroad seeking companions of their own and set up housekeeping for themselves. If by any reason a general break-up of the "lodge" takes place, the young beavers go down stream and the old ones up, as it is easier to build a dam up stream, where the water is shallower, and generally bark from small trees is more easily obtained.

The lodges, if not broken up by man, remain in use for a long series of years, and are admirably adapted to convenience and safety. Each lodge on the bank of a stream has three openings, and sometimes more. The first entrance slopes up gradually from the bottom of the stream to the chamber where the beavers live. By this entrance they bring in their food, which consists of short sticks of wood covered with bark, cut short enough to be turned or handled any way inside of the living room. Another entrance, or way of egress rather, goes straight down from the chamber to a level with the bottom of the river, when it turns squarely and comes out in the bottom of the stream. Down this hole they drop the sticks when they have eaten off the bark, and then drag the white naked pieces of wood out to the bottom to float away. The third entrance is from beneath also, and is sinuous, turning in many ways, and serves a good purpose when besieged by an enemy. All these entrance ways are arched over with sticks and plastered with mud and grass. The bottoms of these entrance ways are also laid with short sticks like corduroy. The lodge or chamber itself is a house from six to eight feet square, laid up against the wall with sticks like a log cabin. When a stick in the wall of this cabin rots, it is carefully removed and another put in its place.

The beaver exercises great diligence and wisdom in procuring and storing its food. Thick bark on the trunks of large trees is not suitable for him and his family, and so they cut down the tree for the smaller limbs, on which the bark is more tender and nutritious. Two nights' work is sufficient to fell a large tree, each family being left to enjoy the fruits of its own labor. It is said they promptly kill all socialists, trouble breeders, and those who are too lazy to work. When a tree on which they are working begins to crackle, they desist from cutting till it begins to fall, when they plunge into the water one after another, "plunk," "plunk," "plunk," till all are in, where they wait with great caution lest the noise of the falling tree might attract some enemy to the place, maybe some fool with a gun. Nor is this all. They know how to regulate the cutting of a tree so as to make it fall always in the water. This is done so as to enable them to transport their short sticks by water to the lodge. Master beaver places it under his throat and pushes it before him to the place where it is to be sunk at the mouth of the entrance way to the lodge.

A book might be written on the beavers' dam. This is, without doubt, the most ingenious and scientific structure built by any creature save man. The object of this dam is to raise and hold the water so as to cover the entrance way to his chamber. This makes the beaver both comfortable and safe. The dam is constructed of sticks, mud, and stones gathered together with great skill and labor. The breadth of the base and top of the beavers' dam is always in exact proportion to its height and length and the volume of water to be held.

Care of House Plants.

Whenever an herbaceous plant begins to drop its leaves, it is certain that its health is impaired in some way. This may be due to several causes, such as being pot-bound, over-heated, exposure to cold or the application of powerful stimulants, as guano, strong liquid manure, alkalies, etc., or to some other cause, which has destroyed the feeding roots of the plant, thus inducing disease and speedy death in all cases where remedial measures are not speedily resorted to. The steps taken in these cases by the amateur are generally the most disastrous course that could be taken toward the plant, short of destroying it at once—that of deluging it with water and applying strong stimulants.

When the nutritive organs of the plants have been destroyed or overgorged, the remedy is very similar—that which nature suggests when animal digestion is deranged—namely, that of giving no more food until it reacts. Then, if the roots have been injured from any of the above named causes, we must let the soil in which it is potted become nearly dry. After which remove the plant from the pot, take the ball of soil in which the roots have been enveloped and crush it between the hands, just enough to allow all the hard outer crust of the ball to be shaken off. Repot in a rather dry soil, which must be light and rich, using a new pot, or if the old one is used it should be well scoured to open the pores, that evaporation may be properly carried on through the sides.

Let the pot be only large enough to allow an inch of space between the sides of the pot and the ball of roots. After repotting give sufficient water to settle the earth well about the roots. Sink the pot in a half shady place or in a box of soil. Do not apply water until the plant starts to grow unless the air is so dry as to evaporate the moisture before any perceptible growth starts. Then of course water must be given in sufficient quantities to keep the soil damp, but no more.

I cannot conceive why people water their plants so much, nor why they should think water such a specific remedy for all the ills to which the plants are heir. The following is a case in point: A neighbor consulting me about the feeble condition of her geraniums said, "I am sure the plants are not suffering from want of attention, as I have watered them copiously twice each day!" I think it is quite safe to assume that half the plants that die in the hands of amateurs are watered to death.

Small white worms sometimes infest pots in which the plants have stood a long time. These are easily discovered by turning the plant out when rather dry, loosening the soil among the roots. Should any worms be found, the roots of the plants may be washed gently in soft water until freed from the old soil, then repotted in fresh earth. If it is not desirable to repot, the pot may be set for a half hour in hot water nearly to the depth of the soil inside. This will drive the worms to the surface without injury to the plant. Enough weak lime water may now be poured on the surface to penetrate the plant roots. This will not only kill the worms, but fertilize the soil.

Ants sometimes cause trouble where pots have been plunged or kept in the ground. There is no way to get rid of them except by repotting. Geraniums often become enfeebled and in many cases die from excessive blooming. This must be corrected by pinching out nearly all the buds as soon as the leaves begin to indicate a decline of vitality by their stunted and discolored appearance.

Danger of Acquiring the Morphine Habit.

Professor Dujardin-Beaumetz, Paris, France, in a recent lecture at the Cochin Hospital, Paris, France, on the treatment of nervous diseases said: I need not here speak of the advantages and dangers of morphine. I have many times discussed this subject, showing that if morphine is an admirable analgesic medicament, it is also the most dangerous of all by reason of the fact that the patient becomes accustomed to and dependent on the morphine injections, and ends in becoming a morphiomaniac.

It may be affirmed that morphiomania has become one of the vices of the day, and we may almost lay it down as a rule that any patient who for thirty consecutive days takes morphine injections will ever after be a victim to the habit, even when the symptoms of the primary malady shall have completely disappeared; and it will thenceforth be a matter of no little difficulty to cure the morphine habit, now become a disease more rebellious than the affection for which these injections were first ordered.

The number of morphiomaniacs increases every day, and this deplorable vice exists in all classes of society. Unfortunately, our own profession is not exempt from this abuse, and I know quite a number of medical *confreres* who have been or are still victims of morphine.

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RECENTLY PATENTED INVENTIONS.

Electrical.

SWITCH BOARD.—William M. Stewart, Schenectady, N. Y. This is a board for central electric lighting stations using alternating currents, the board being designed to make connection between any of the dynamos of the station and any of the circuits running out of the station, so that any or all of the circuits may be switched on to other dynamos.

Railway Appliances.

CAR TRUCK.—Lee C. Sharp and John A. Gutsche, Plattsmouth, Neb. This invention covers novel features of construction designed to afford improved means for the distribution of the load strain upon the axles, whereby frictional resistance is greatly reduced, heating of the bearings obviated, and the load-sustaining capacity of the axles greatly increased.

Miscellaneous.

BURGLAR ALARM. — Noah M. Powell, Reger, Mo. This invention covers a suitable housing and platform scale, the platform being connected by electric circuits with alarm bells and indicators, so that any one approaching the safe will cause the alarm bells to ring, and indicate the manner of approach.

STREET SIGN FOR LAMPS.—Theodore Cocheu, Brooklyn, N. Y. This is a street sign or indicator, designed more especially for use with electric lamps, to be easily read by daylight or at night, the sign plates being arranged in peculiar positions relatively to the lamp body or frame and the plane of the light arc or burner.

LIFTING GOODS FROM SHELVES.—John H. Jeffrey, Crescent City, Cal. This invention covers a novel apparatus or device designed to afford facility in lifting goods or packages of any character from shelves or high supports, obviating the necessity of using a ladder in order to reach them.

CIGAR CASE AND EXTINGUISHER. — John Smith, Buffalo, N. Y. This case has a conical body in two sections, one section having an exterior pocket and the other section being provided with interior spring fingers, whereby a lighted cigar may be placed in the case, extinguished, and carried in the pocket, to be kept for further use.

RULER. — Oscar S. Matthews, Dallas, Texas. This is a ruler capable of being bent and conforming itself to curved or undulating surfaces, the invention covering novel features designed to prevent all clotting, blurring, or blotting, and insure straight ruling on curved or undulating surfaces.

CALCULATOR. — Willard D. Otis, Blue Springs, Neb. This is a device designed to quickly and accurately reduce a load of grain or seeds to bushels and fractions thereof, or to compute the price of hay, grain, coal, or other article, and indicate the amount of money to be paid or received therefor.

HOUSEHOLD FURNITURE. — Martin J. Walsh, Parsons, Pa. This invention provides for an article combining in one piece a kneeling or prayer bench, a desk, and a table, the several parts of which are so made that they may be folded up to occupy only a small space when in use simply as a kneeling bench.

GUARD FOR BEDSTEADS. — Louis E. Meyer, St. Louis, Mo. This is a device to prevent people from falling out of bed, and consists of a frame with two folding sections adapted to be readily clamped on the side rail or board of the bedstead, and to be conveniently taken off and set aside when not needed.

TOILET MIRROR.—Joseph Manheimer, New York City. This mirror has a supporting handle hinged to its back, and a comb case or pocket attached to the hinged handle, providing for holding the comb always conveniently at hand.

IMAGES ON METALLIC MIRRORS. — Carl Wegener, Moscow, Russia. This invention provides for making invisible images capable of being rendered visible on another surface by reflected luminous rays, the image being formed on the metallic mirror by etching, engraving, etc., and then rendered invisible by grinding and burnishing the polished surface.

HOSE COUPLING. — Isaac D. Weaver, Lebanon, Pa. This is a coupling especially adapted for use in connection with steam-heating apparatus for railway trains, and the invention is designed to provide a simple and durable device in which washers and other leaky contrivances may be dispensed with.

BALE TIE BUCKLE. — Robert W. Carroll, Memphis, Tenn. This is a buckle of simple and strong construction, designed to be manufactured at small cost, and when the bent ends of a hoop or band are passed through it, longitudinal bars hold the short ends bent under the sides of the buckle to render it impossible for the strain on the hoops to pull and straighten out the ends.

ARTIFICIAL DENTURE. — John A. Throckmorton, Sidney, Ohio. This invention relates to an improvement in the means for holding artificial teeth in the mouth, and consists in providing the bridge work with arms to clasp the bridge work to the natural teeth, and with a supporting plate to clasp over the gums.

REMOVING INCRUSTATION FROM BOILER TUBES.—James P. Karr, Monticello, Ind. This is an improvement on a formerly patented invention of the same inventor, for an apparatus designed to temporarily enlarge the boiler tube in opposite directions, so that the scale will fall off while the tube will spring back to its original shape.

REFRIGERATOR BOX. — Frederick Beinhauer, New York City. This is a box so made as to be readily taken apart for transportation or to facilitate cleaning, being made in three principal sections—a bottom section, a front section, and a back section—the invention providing a construction designed to utilize the ice to the best advantage.

PIANO. — Edmund R Holmes, Tokio, Japan. This invention covers an improved construction of bridges for the strings of a piano, and the arrangement of the parts, whereby the contraction and expansion of the strings are reduced to a minimum.

FAN SUPPORTING BRACKET.—Joseph J. Schmidt, Jamaica, and Carles A. Jonson, Brooklyn, N. Y. This is an adjustable fan support, in which the parts are so arranged that the fan-supporting frame may be folded back out of the way when the fan is not in use.

DITCHING MACHINE. — Henry Carter, Albion, N. Y. This invention covers an improvement on a former patented invention of the same inventor, being a machine for cutting and clearing or excavating ditches or trenches by means of a plow or share, and having a large elevating wheel fitted with scoops to lift and discharge the soil.

FIRE ESCAPE.—William M. and George Taylor, Gorlestou, England. This is an apparatus in which a lowering rope and winding and unwinding pulley are used, in combination with a brake pulley, friction cord, and spring, the apparatus, after each descent, automatically setting itself for a fresh load.

COFFIN FASTENER.—William J. Noble, New York City. This device has a base plate with upwardly projecting socket having a segmental slot in its upper edge, an angle arm being held to revolve in the socket with a lug or stop extending downward within the socket recess, whereby the lid may readily be firmly secured to the top of the case.

LOCK FOR HOOPS.—John H. Mitchell, Bloomfield, Iowa. This is a fastener consisting of oppositely beveled blocks having vertical grooves on their opposite faces for receiving a fastening wire, the beveled faces of the blocks being toothed, while one of the blocks is slotted and the other has a staple through which the fastening wire may be passed.

DUMPING CART.—Thomas Hill, Jersey City, N. J. The cart body is provided with side trunnions or pivots and leaf springs carried by the running gear, with other novel features, the design being to so mount and support the shafts upon the axle that there will be practically no rattling and the draught animal will be relieved of all undue shock and jar incident to the movement of the vehicle over rough ground.

SHAFT DETACHER. — Flor S. Pollitt, Harrodsburg, Ky. Combined with the shaft clip is a pivoted plate provided with an upwardly projecting arm adapted to overlap the head of the thill bolt and the nut by which the bolt is held to place, with means for operating the pivoted plate, whereby the shafts may be quickly disconnected from their supporting clips.

HORSE MUZZLE.—Benjamin S. Seaman, Corning, N. Y. This muzzle is made up of a number of scraps of leather arranged in series, each series connected to the adjacent series by a wire, and the ends of the scraps interlocking, making a strong and durable muzzle which will not hurt the horse, and which can be made at small cost.

HARNESS. — Edward Clark, New York City Combined with the saddle girth are links having openings between their ends and pivotally connected at their lower ends to the girth below the line of the thills to adapt them to engage and slide freely on longitudinal bars on the under side of the thills, whereby the animal will be permitted to draw with great ease.

CANT HOOK. — Alfred E. Creigh, Ronceverte, West Va. This is an implement for use in driving logs on rivers, and the general handling of logs, the metal pike being fitted into a socket composed of four sections, and both it and the point being readily removable when they become worn or dull.

HAME TUG. — James D. McAnally, Waterloo, Ind. This tug consists of an inner and outer plate, the latter having in its outer face a number of under-cut cross grooves or channels to receive the rib on the trace attachment, the device being designed to obviate the use of trace buckles and the consequent weakening of the parts to which they are applied.

JAR LID FASTENER. — Charles P. Maiser, Allegheny, Pa. Combined with a neck wire formed with eyes, in which are pivoted the ends of bails, is a locking lever formed of a single piece of curved wire, the lever folding down flat on the lid, so that the jars can be placed one on top of the other in packing,

LINK FOR BRACELETS, ETC.—Antoine J. Kerckhoffs, New York City. This invention provides a hinged joint of economical construction and great strength and solidity, and one which will render the links or parts connected pliable only upon one side, whereby the article may be made to better fit the portion of the body it is adapted to ornament.

INKSTAND — John R. Droney, Kane, Pa. The parts of this inkstand are so arranged that the depression of the pen within the delivery funnel acts to force a supply of ink upward within the funnel, the ink within the well being sealed and cut off from communication with the atmosphere, whereby evaporation is prevented.

SELF INK DISTRIBUTER.—Samuel D. Henry, Coon Rapids, Iowa. This is an apparatus adapted for use in connection with hand newspaper presses, combining an ink board, an ink trough, and a reciprocating carriage, with other novel features, to insure the even distribution of the ink upon the forms and increase the speed of the press work.

NEW BOOKS AND PUBLICATIONS.

THE CLOCK JOBBER'S HANDYBOOK. A practical manual. By Paul N. Hasluck. London: Crosby, Lockwood & Son. 1889. Pp. 159. Price 80 cents.

The entire subject of repairing clocks of different kinds, German, American, French and others, a treatise on escapements, pendulums, and striking mechanisms, are all comprised within the pages of the present book. Cuts are very liberally used to illustrate clocks, their movements, and special tools for use by the clock maker. The thoroughly practical character of the text and illustrations, of which latter there are over 100, give a decided character of utility to this volume.

A HANDBOOK FOR SUGAR MANUFACTURERS AND THEIR CHEMISTS. By Guilford L. Spencer. New York: John Wiley & Sons. 1889. Pp. 126. Price $2.

In the 126 printed pages of this book chemical control of sugar house work is treated of. Illustrations are used where required, and all the different sets of analyses and tables for practical use, both of specific gravities of solutions and other data, are given. Bound in the same cover are a number of pages ruled off for taking notes of practical sugar house working, followed by blank pages for personal notes. The whole will be found very useful to sugar house chemists.

MONZERT'S PRACTICAL DISTILLER. By Leonard Monzert. New York: Dick & Fitzgerald; London: Trubner & Company. Pp. 156. Price $3.

The distillation of liquor is a subject concerning which it often seems difficult to get real, practical information. The present work aims at filling up such a vacancy. The manufacture of beer, liquors, essential oils, alcohol, and vinegar are all given place, and treated in a very practical way. Nineteen illustrations are embodied in the book, while numerous tables and collections of data make it of much value to all interested in the subject.

The Illustrated American.—The first number of a splendidly illustrated weekly newspaper has just been issued, and is a beautiful specimen of artistic and typographic work. This periodical ranks with the best French and German illustrated papers, and contains the best class of photo-engravings, and with each number a colored lithographic reproduction of some well known painting or work of art is promised, and the first is a copy of Edward Detaille's Comrades of the Desert. The paper is the same size as *Harper's Weekly*, and contains 24 pages, besides a colored cover and supplement. The reading matter will be entirely free from political discussion, and will be unsectarian. It will contain descriptive articles of travel, etc., as well as several novels and short stories. We welcome this newcomer to the newspaper fraternity and wish it every success. The *Illustrated American* is published in New York, and those wishing to subscribe should address Maurice M. Minton, general manager, Bible House, Astor Place, New York, or 142 Dearborn Street, Chicago, Ill.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY NUMBER.—(No. 52.)

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1. Elegant plate in colors of a cottage on Staten Island, N. Y., from drawings and specifications supplied by Munn & Co. Perspective elevation, floor plans, and details.
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3. An ornamental carriage house at South Orange, N. J. Perspective elevation.
4. Engravings of the new auditorium building, Chicago, Ill.
5. A Staten Island cottage, costing $3,300 complete. Floor plans and perspective elevation.
6. A residence at Portchester, N. Y. Cost $11,500. Lamb & Rich, New York, architects. Plans and perspective elevation.
7. A dwelling at Hill View, Dunwoodie, N. Y. Cost $5,100 complete. Floor plans and perspective elevation. Architect, C. E. Miller, New York.
8. Design for a cottage at Mystic, Conn., by F. W. Beall, architect, New York. Elevations and floor plans.
9. A double dwelling house at Stamford, Conn., erected at a cost of $7,800 complete. Plans and perspective.
10. Cottage erected at Larchmont Manor, N. Y. Cost $4,350. Floor plans and perspective.
11. The new Carteret club building erected at Jersey City Heights, N. J., from designs by Bradford L. Gilbert, of New York. Cost $20,000.
12. The Oriel Row of thirteen houses, San Francisco, Cal. Erected at a cost of $5,800 each. Plans and perspective.
13. A recently erected cottage in "Iselin's Park," New Rochelle, N. Y. Cost $6,000. Perspective and floor plans.
14. A very pretty cottage at Hill View, Dunwoodie, N. Y., recently completed at a cost of $5,000. Chas. E. Miller, architect, New York. Floor plans and perspective elevation.
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HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1866) W. H. S. asks: 1. Will you kindly state why the wires leading to and from a telephone and other electrical instruments are made in spiral form? A. The wires are generally wound in a spiral to increase their flexibility and avoid breakage. 2. Having a dynamo of certain E. M. F., how would the operator arrange to increase the amperage and decrease the voltage? A. This can be accomplished only by rewinding the armature with coarser wire and connecting the sections of the field magnet wire in parallel. Rewinding of the field magnet with coarser wire may be found necessary. 3. To increase the voltage and decrease the amperage, has the operator any control in this respect of the dynamo? A. The E. M. F. can be increased by increasing the speed of the armature or by increasing the strength of the magnetic field. The amperage may be reduced by putting resistance in the circuit.

(1867) D. J. J. asks for formula of chemical solution that, when paper is saturated in it and dried, a current of electricity coming in contact with it produces a black mark. A. Iodide of potassium solution produces a dark brown stain, and is probably what you allude to. The paper must not be perfectly dry.

(1868) Millwright says: Among our millwrights the question has arisen whether a belt will travel toward the highest or lowest side of a pulley. A. The question is much misunderstood in its two bearings. With parallel shafting, belts run to the high or larger part of conical and crown pulleys. With shafting out of line, with straight or low crown pulleys, belts will run to what is called the low side, or side toward which the shaft ends are nearest.

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(1869) W. H. S. asks: 1. If you take a bar magnet and cut it in half at the neutral points, would each of the cut ends become poles? A. Yes. 2. If you cut it 1 inch from the negative pole (supposing the bar to be say 4 inches long), what would the end opposite the negative pole be, that is, on the 1 inch piece? A. Positive. 3. If you were to cut a wire leading to an electric arc light when the light was burning, and then connect the two cut ends by a non-conductor, the current still flowing, would the non-conductor be consumed? A. In this case no current will flow unless an arc is formed. If an arc is formed, any substance placed in the arc would be melted and dissipated or consumed.

(1870) B. B. asks: 1. Is the Mississippi, exclusive of the Missouri, the longest river in the world? A. No; the Amazon, 3,900 miles. 2. Would a sun large enough to fill the whole orbit of this earth appear but a point of light viewed from a star that has no parallax? A. Yes. 3. Has Capella any parallax? A. We have no measures in our list. 4. Toward what star or constellation is the solar system supposed to be going? A. Toward the constellation Hercules. No particular star can be named. 5. Does our sun form one of the stars of the milky way? A. No; it is central. 6. Is the sun supposed to throw heat into space where no planet or comet resists it? A. It generates ether waves in all directions, which only develop heat by impact upon matter. The term "radiant heat" is now abandoned by many advanced scientists, although retained by many as a matter of convenience.

(1871) A. C. W. asks: 1. Can hard rubber, such as is used for electrical purposes, be turned in a lathe? A. Yes. Use such tools as are used on hard wood. 2. Not long ago I saw a small electric motor which worked equally well on a continuous or alternating current. The field magnets consisted of a bar of soft iron wound with No. 14 B. and S. gauge, the ends of the bar terminating in pole pieces. The armature was of the I type, made of sections of charcoal iron, and was also wound with No. 14. The machine was connected in series. Was its action on the alternating current due to the soft iron used in the field magnets and armature? A. We doubt if you ever saw such a motor. It is possible that the Tesla motor effect, due to lag of period, might obtain in a common dynamo. 3. How do you find the horse power of an electric motor? A. Its actual power is determined by a brake, as in the case of an engine or water wheel.

(1872) J. P. O. asks: How far is the light-house at Houstholm, Denmark, visible by mariners at sea? Also please state the distance that lights can generally be seen at sea. Please tell me how far the two million candle power could be seen under most favorable circumstances by the naked eye. A. We do not know the height of the light above the sea, which is essential to obtain the datum which you ask for. If it is 150 feet high, it can be seen from the masthead of a ship at from 35 to 40 miles. The two million candle power can be seen no farther, but gives a stronger light in hazy weather.

(1873) J. A. H. writes: We are desirous of finding the composition and proportions of the common match which has sulphur on the stem, as we want to experiment in our class. A. Experiments of this nature are exceedingly dangerous. The following gives an idea of the formulas, which are very numerous and varied:

Red phosphorus	2	parts by	weight.
Nitrate of potash	5	"	"
Glue	3	"	"
Red lead	1½	"	"
Water	12	"	"

Mix on a water bath. After coating the ends of the splints with melted sulphur, dip them in the mixture. Do this after the sulphur is quite cold.

(1874) F. H. says: If I have two columns of any metal, say wrought iron, being of the same diameter, but one of them hollow, is it possible that, making the hole in the hollow column a certain size, said column will better resist a force of a certain magnitude, tending to break it, than the solid column? A. The solid column will resist the greatest strain. It is the economy of a given weight of metal in a solid or hollow column that gives preference to the hollow column, because, with equal weights, the hollow column is largest, which gives it greater stiffness from bending forces, and may give it greater crushing strength, due to compact grain, and bracing effect from its annular form.

(1875) E. B. asks: 1. What metals expand the most? A. Of common metals, zinc expands the most for a given rise. 2. Is there any metal or combination of metals which, when heated say to same heat necessary to vulcanize rubber, will expand, and retain the expanded size when reduced to ordinary temperature? A. Rubber vulcanizes at 276° Fah. There are no alloys that melt at this temperature that expand and remain so. An alloy of 75 parts lead, 16·7 antimony, 8·3 bismuth expands in solidifying, but melts at a much higher temperature than that used for vulcanizing. 3. For my purpose I want a metal that will expand and remain so, be tough, hard, ductile, and malleable, the latter two not necessarily essential, though desirable, and can I obtain it? A. We know of no such alloy or metal. 4. How many degrees of heat Fah. can I obtain with a mouth blowpipe in a small furnace made after directions given in "Experimental Science," how many degrees with a mechanical blowpipe? A. You can get about 1,500° F. with a mouth blowpipe. With a small bellows you can get about 2,500°, and can melt small amounts of gold, silver, brass, and copper. 5. Explain difference between Centigrade and Fahrenheit. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 141, for full size comparison scales of Fahrenheit, Centigrade, and Reaumur thermometers. 6. Have any patents been taken out for the manufacture of aluminum from clay, cryolite, or feldspar, as an article of commerce? If so, please furnish numbers of patents, and I will remit for copies. A. There are many patents on the manufacture of aluminum. We can furnish copies for several years back at 25 cents each. 7. Is there any known affinity for aluminum, such as a magnetic affinity or the use of mercury for the extraction of gold? A. Aluminum is not magnetic, nor has mercury any affinity for gold except by contact, when it forms an amalgam. 8. What are the component parts of cryolite, feldspar, and clay? A. You will find analyses of cryolite, feldspar and clay in Dana's Mineralogy, $3.50, mailed. 9. In what is aluminum found freest? A. Aluminum is easiest reduced from cryolite. 10. Will the heat of a Bunsen burner flame be augmented by use of blowpipe? What flame gives the most intense heat? A. The heat of a Bunsen burner will be increased, if applied as a blowpipe. For a small blowpipe an oil lamp gives the most intense heat.

(1876) J. A. B. asks: 1. What is the simplest method of making gunpowder? A. By mixing charcoal, 15 parts; sulphur, 10 parts; nitrate of potash, 75 parts. Grind them separately, mix with a little water and grind to impalpability. Roll out while wet, into small cylinders, which cut up or break up into grains after drying. 2. I have a 50 light Edison machine. What number wire should I wind with? A. It depends on the type of machine. Apply to the Edison Manufacturing Company, of this city, giving designation, etc., of machine. 3. How is the so called patent leather made? A. By japanning, with special precautions and skill. The following is a formula for the japan: Burnt umber, 8 oz.; asphaltum, 3 or 4 oz.; boiled linseed oil, 1 gallon. The umber is to be ground in a little of the oil, the asphaltum dissolved in a little, and the whole mixed. It may be thinned with turpentine.

(1877) F. C. says: 1. After a steam gauge freezes, what action has the frost on the spring to cause the pointer to be on the wrong side of the pin? and if you steam up, the pointer will come back and show how much the frost has weakened the spring. I can't see how a steam gauge can freeze until the steam goes down in the boiler and the pointer comes back to the pin. It seems a mystery to me how the pointer can get on the other side of the pin. And when you find out how much it is weakened, what is the best way to get the spring in its right position again without sending it to the factory where it was made? A. The pipe leading to a steam gauge is or should be filled with water, and is liable to freeze by exposure. In the freezing of a steam gauge the pointer may be thrown clear around against the pin by the expansion of the water in the pipe, supposing it to have commenced to freeze at a little distance from the gauge first. You can take off the head and reset it, but the probability is that the relation of the gauge to the dial marks will be changed, and the gauge become unreliable. Better send it to be repaired and tested.

(1878) X. asks: Can a large thick-coated cat emit or rather transmit enough electricity to a person for an electric shock to be felt? A. A slight prickling or even a shock can be thus obtained under favorable conditions.

(1879) A. C. R. writes: I have three or four hundred Indian darts or flints, one tomahawk and one knife. Can I arrange them so they would be attractive? A. Mount them by fine wires in regular design upon a plush-covered board and frame the whole.

(1880) J. M. writes: Can you tell me of any chemical compound which, when poured into a frozen water pipe, will generate such a heat that the ice in the pipe will be thawed out? A. Alcohol is often used to thaw out water. The trouble with all the methods is that the hot water stays in the top of the pipe, and the heat does not descend. Strong chemicals should not be used.

(1881) T. S. writes: If two round light openings be equally exposed to the rays of the light, one 2 inches in diameter and one 1⅓ inches in diameter, what relative percentage of light will pass through the openings? A. The light will vary as the area of the openings, or what is the same thing, in the ratio of the square of their diameters, viz., in the proportion of $(2)^2$: $(1\frac{1}{3})^2$ or 4: 1⅓. The large opening will pass more than twice the amount of light.

(1882) Theta wants a formula for a toning bath to obtain good black or purple tones on ready sensitized paper.

A. Chloride gold	1 gr.
Borax	60 "
Water	4 oz.

See SCIENTIFIC AMERICAN, page 225, April 13, 1889. 2. If a small single combination lens with an opening F-16 would be available in a hand camera, using dry plates with sensitometers 25. A. Yes; but only the center portion of picture will be sharp. A small diaphragm will be necessary for fine definitions. Single combinations are usually slower than double. Dallmeyer makes a special single combination lens for handcameras that is rapid.

(1883) P. A. S. asks for the method of galvanizing wire, the materials used, etc. Can the metal be melted in an ordinary iron kettle? What temperature does the metal melt at? What is used to make the melted metal adhere to the wire? A. The iron is pickled in sulphuric or muriatic acid and water in equal parts. It is then scrubbed with sand or emery, and immersed in bath of equal parts of saturated solutions of chloride of zinc and chloride of ammonium. It is then dipped into melted zinc; to every 640 pounds of which 106 pounds of mercury, and 5 or 6 ounces of sodium have been added. The bath can be melted in cast iron. Its temperature should be about 680° Fah. The mercury and sodium can be dispensed with and a simple bath of melted zinc can be used. Zinc melts at 671° Fah.

(1884) W. S. C. writes: As a reader of over twenty years' standing of your valuable paper, I beg to ask the following: Last week a man jumped from a bridge at an elevation of it is said, 285 feet. Supposing the jumper weighed 160 pounds, with what force did he strike the water and how is the computation made? A. No direct answer can be given. If we assume that he sank two feet before the energy due to the fall was exhausted, his $285\times160=45{,}600$ foot pounds of energy would be reduced to an average of $\frac{45{,}600}{2}=22{,}800$ lb. average pressure extending over the two feet. There is no fast rule. Beaufoy experimentally determined that 1 pound striking with a velocity of 1 foot gives a pressure of 0·5003 pound. This applied to your case would give $160+160\times0{\cdot}5003\times(135)^2$, or about 1,458,000 pounds. But Beaufoy's results are fallacious, as the blow depends on the relative distances of fall and space traversed in coming to rest.

(1885) U. S. S. Co. asks how to tin or copper iron by a cheap process. A. Iron may be coppered lightly by simple immersion for very short time in a solution of sulphate of copper (blue vitriol). To give a substantial coating it must be electroplated. To tin iron it must be pickled and then run through a solution of chloride of zinc with a little sal-ammoniac and then through a bath of melted tin. The tin bath should be protected from oxidation by a layer of melted charcoal, or even tallow may be used.

(1886) J. D. R. writes: 1. Will you give through your paper instructions for cleansing and purifying old zinc for battery purposes? A. Scrub with sand and water and a stiff brush or stick of wood whose end has been beaten into fiber. If to be amalgamated, use a little acid. 2. Is there any process by which we can reclaim or restore old, worn-out porous cups, such as are used in the Leclanche batteries? A. Such cups are best discarded if really worn out, otherwise soaking will clear out the pores. 3. What is the most simple way to measure the resistance of a battery? A. By putting two cells in opposition and doing it by the tangent galvanometer or Wheatstone bridge. But in this case the two cells must exactly neutralize each other.

(1887) E. M. asks for a formula for a good liquid shoe dressing that can be made cheaply. A. We have published several blacking formulas recently. They are very numerous. One reads: Ivory black and molasses, of each ¼ pound, oil of vitriol 1 ounce, meal oil 2 ounces, sour beer 1 pint; after mixing thoroughly it may stand for some hours and then be thinned to desired consistency with water.

(1888) X. X. X. asks for the process for making baker's bread. A. Six to 12 pounds of potatoes are washed, and boiled thoroughly. When cooled to 85° Fah., one quart of brewer's yeast and 1 or 2 pounds of flour are added. After four or five hours' fermentation the head falls in. It is left for two or three hours after this occurs. From 70 to 90 pounds of flour are mixed with water at 85° Fah., and the above leaven or ferment is forced through a sieve and intimately mixed with this flour, giving the "sponge." The potato skins and flour left on the sieve are washed with the water added. About 30 quarts of water suffice for the sponge. It is allowed to rise and break twice, which requires about an hour for each break, and then enough flour, from 190 to 210 pounds, is added to make, with what has been added, 280 pounds. Thirty quarts of water are added and about 3 pounds of salt. It is kneaded, allowed to stand an hour, and "scaled" into loaves, and baked, the oven being at 400° Fah. to 450° Fah. There are many variations on above. For an excellent treatise we refer you to "The Complete Bread, Cake, and Cracker Baker," $3.

(1889) F. R. W. asks: 1. What number of tons of white lead are there produced yearly? A. About 70,000 tons, by upward of 30 manufacturers. 2. How many different processes are there used? A. This is impossible to answer; perhaps three or four distinctive processes. 3. Is not the acetic acid process, or what is known as the Dutch process, the one in common use? A. Yes; and the best, in general estimation. 4. In the Dutch process, what percentage is figured for the cost of labor, and what for the acid? A. Such figures cannot be obtained. They vary for different localities. The white lead manufacturers are apt to be very secretive; many consider that they have trade secrets, and others adulterate with barytes, etc.

(1890) J. H. D. asks: 1. Will you kindly give me the formula for preparing a photographic printing paper called Pizzighelli or gray paper? A. See full details in SCIENTIFIC AMERICAN SUPPLEMENT, No. 636. 2. Are there any positive celluloid films manufactured which can be used in the camera in a similar manner to the dry plate ferrotype? A. No. White celluloid is coated with the emulsion, on which positive pictures may be made either by contact or in the camera from a negative. The Seed Dry Plate Company, of St. Louis, Mo., supplies them. What are the chief adulterants of linseed oil, and what is the present New York market price for the pure article? Is there any simple test by which the presence of adulterants can be detected? A. Resin oil and fish oil are two of the principal adulterants of linseed oil. Their detection should be entrusted to a chemist. Linseed oil is worth now about 60 cents a gallon.

(1891) C. H. G. asks: What is the difference, if any, between a laminated and Damascus steel barrel? There are gun barrels called laminated steel bar, Damascus steel bar, and Damascus barrels. A. The laminated barrels have a thread-like appearance in the twist that lies parallel and even along the direction of the twist. The Damascus barrels have a fine curl along the twist. The forms of this curl are made by welding two or more twisted rods together and then twisting the combined rod, from which the gun is made.

(1892) A. B. writes: 1. Can you give me a receipt that will not injure the growth but will hasten the hair to turn gray? A. We cannot. You can bleach it with binoxide of hydrogen. 2. In your description, "How to Make a Simple Telephone" (magnetic), you do not give directions as to the signal call. Can the magneto bells be adjusted so as to be used on the same wires? If so, how? A. See SUPPLEMENT, No. 162.

(1893) L. A. W. asks (1) for a receipt for making liquid bluing. A. Use soluble Prussian blue. Ordinary Prussian blue may be dissolved in oxalic acid. The mixture is highly poisonous. 2. Also, how to make white soap for laundry purpose? A. Saponify 6 pounds fat with 1 pound caustic soda and a little water. You should procure some manual on the subject, as there are many details and variations into which we cannot go.

(1894) W. L. asks if it is possible to set violin strings in vibration on a violin by applying on same compressed air through a flat nozzle ¾ by 1-100 of an inch in size, or any other similar proportion, and if practicable, how high pressure will be needed. A. You will find it difficult to do it satisfactorily. The conditions of air blast required to vibrate a string have never been satisfactorily determined. In some cases the angle at which the air strikes a wire seems to make a great difference in its power of causing vibration.

(1895) E. A. H. asks whether there is any method by which phosphorus can be applied to the face of a clock, or hands of same, without damage to clock or danger to person handling same. A. For this purpose you should use Balmain's luminous paint. Phosphorus could be dissolved in oil and smeared over the face, but would soon become exhausted. Either would cost but little, but the paint would last a long time.

(1896) C. L. asks: Could you give me a good working formula for making blue fire? A. For use in tubes mix:

Chlorate of potash	3 oz.
Sulphur	1 "
Ammonio-sulphate of copper	1 "
For firing as powder in pans:	
Nitrate of potash	8 oz.
Sulphur	2 "
Sulphate of copper	4 "

(1897) Marion asks by what recipe or process the beautiful gloss which I see on gentlemen's linen brought from the United States is obtained. A. It is principally by superior manipulation and by good polishing sadirons. A little kerosene or paraffin wax is sometimes added to the starch. In our SUPPLEMENT, No. 577, we give an article on the subject.

(1898) W. F. W. asks: 1. How can I clean bottles which have contained a stannous chloride solution? The white coating on the sides and bottom is difficult to remove. A. Rinse with hydrochloric acid. 2. How can I remove a stain from a woolen carpet occasioned by spilling kerosene on it? A. Try fuller's earth. Mix with water to a thick paste, make a little heap over the spot, and when perfectly dry remove and sweep.

(1899) T. C. R. asks for a good receipt for coloring gold. A. It is done by boiling in strong sulphuric acid. This dissolves the alloy and leaves pure gold on the surface.

(1900) W. B. P. asks: When a man dies, how do all the newspapers throughout the land get his portrait for the next issue of the paper? A. Often the likeness is prepared a few days before the death, when it is anticipated.

(1901) H. J. D. asks: 1. How is commercial natrium æthylat manufactured? A. By dissolving metallic sodium in alcohol; the latter should be absolute. 2. How is hydrogen peroxide made, and what are its uses? A. By treating binoxide of barium with dilute sulphuric acid. It is used as a bleaching agent, especially for hair.

(1902) P. J. L. asks: 1. What are the cheapest white and light colored metals that will not tarnish, and that can be milled, moulded, or both, and what kind of moulds would be best to use for casting the same for small parts of machinery? A. Many receipts for white metal alloys are given in the books. German silver is perhaps as available as any. Cast it in sand moulds. 2. Is there a dull colored plating for brass that wears as well as nickel plating? A. Use tinning.

(1903) M. A. H. asks regarding chromic iron ore: 1. Is it very expensive to manufacture chrome yellow from it? A. It involves considerable plant, and may be classed as rather an expensive operation. 2. What is its commercial value? A. For value address a broker in iron ores.

(1904) D. H. asks: How can I make a thin, clear, and yet adhesive mucilage, similar to that used on the back of postage stamps?

A. Dextrine	2 parts.
Acetic acid	1 "
Water	5 "
Alcohol	1 "

(1905) C. T. asks for a recipe for a good and cheap furniture polish. A. Dissolve 4 ounces shellac in 2 pints strong alcohol, add 2 pints linseed oil and 1 pint spirit of turpentine, then 4 ounces ether and 4 ounces aqua ammonia. Shake when using.

(1906) St. P. A. asks for a receipt for erasing ink stains out of white paper. A. Oxalic acid dissolved in water and mixed if desired with a little tartaric acid may be used.

(1907) F. E. K. J. & J. E. C. ask how copper plate printing is done, where the fine lines on the plate are filled and transferred to the paper in raised letters; what is used to prevent the ink from taking on the surface of the plate. A. The plate is inked all over and then is wiped off with a cloth. This removes all the ink except what is left in the lines. A roller press giving very heavy pressure is used.

(1908) C. S. R. asks: Will you inform me where I can find the geometrical construction of polygons of 7, 9, 11, 13, and 17 sides? A. You must do them tentatively for the most part. Special methods might be worked out for some of them.

(1909) A. L. C. asks: 1. Will you tell me what gas is generated by placing silver in nitric acid? A. Nitrogen dioxide, N_2O_2, which oxidizes in the air, forming higher oxides, probably N_2O_4 for the most part. 2. What is precipitation? A. The formation of a solid insoluble substance in a solution. 3. Is it safe to generate oxygen in an iron retort? A. Yes, if your chemicals are pure. 4. How is the location of a break in a telegraph wire detected when the ends do not touch the ground? Also how is a break in a submarine cable located? A. By determining the capacity of the unbroken part, or if the cable communicates at the break with the water, by testing its resistance.

(1910) H. B. asks: A recipe for the component parts of the hektograph. A. We refer you to our SUPPLEMENT, No. 438.

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(1911) J. L. asks how to grind the interior of glass tubing to prepare for making level vials? Give best way to prepare, or rather obtain a level surface in interior of glass tubing. A. Glass tubes for levels of transits and other surveying instruments require to be selected from parts of the long commercial tubes, with care as to parallelism in their cylindrical form, and cut from the tube, a calipers being used to find the proper sections to be used. A brass rod is made a little longer than the section and slightly smaller, which is turned slightly bulging in the center, the difference between center and ends being not over $\frac{1}{50}$ of an inch, with as true a curve as possible. This, with the finest flour of emery and water, is used to grind the inside of the tube. In doing this the tube should be examined to find if it is perfectly straight or slightly curved, which must be considered in the grinding operation. Much judgment and experience is required to do this so as to obliterate any ridges or unevenness and bring at least one side to a perfect curve. In tubes for leveling instruments at least $\frac{2}{3}$ of the circumference of the inside should be perfect. A trial can be made by filling and corking the ends, when, if not satisfactory, any defects may be corrected before sealing the ends.

(1912) F. W. M. asks: Which do you think would be the most practicable for tricycles, safeties and other road machines—steam or electricity? What proportion do you think of the machines sold throughout the United States would be power machines, if the extra cost did not exceed $75, and perhaps not but $50, and extra weight less than 30 lb? A. At present there are serious difficulties with both applications in the increased weight and attention required. If this and the large expense could be somewhat overcome, large numbers would be used.

TO INVENTORS.

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February 11, 1890,

AND EACH BEARING THAT DATE.

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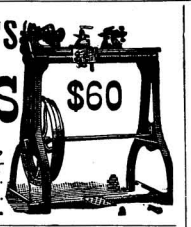

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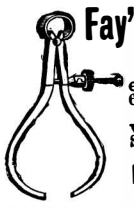

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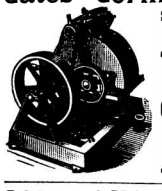

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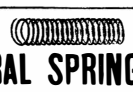

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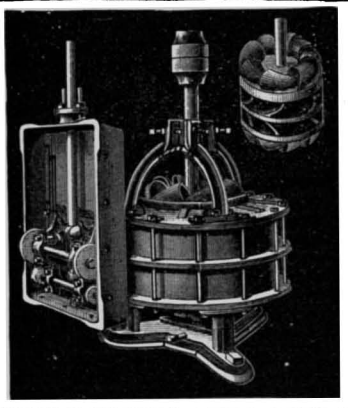

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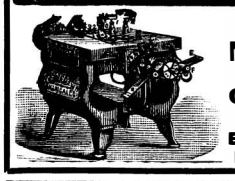

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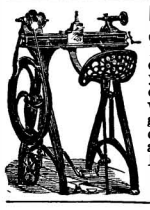

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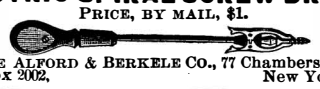

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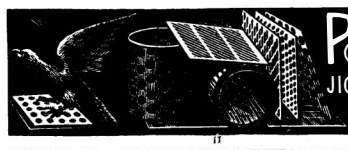

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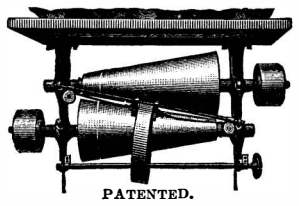

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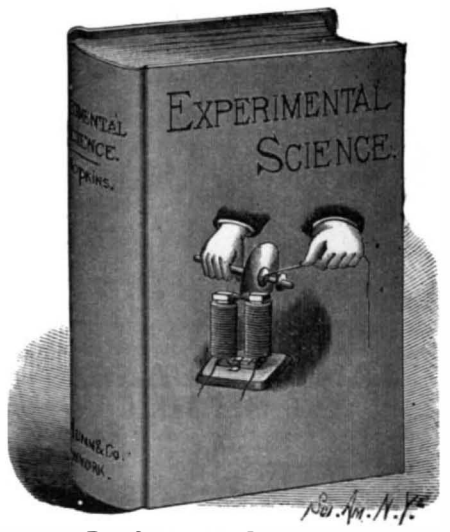

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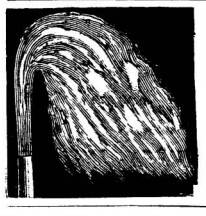

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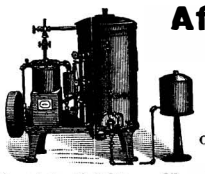

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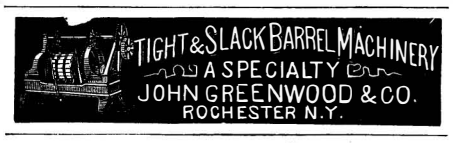

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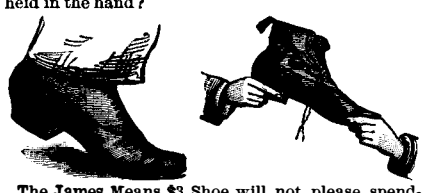

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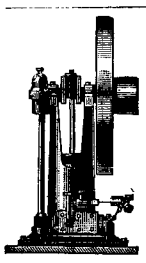

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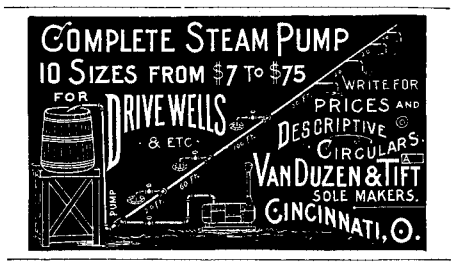
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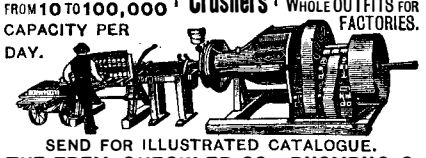

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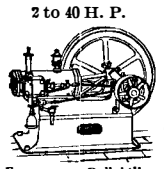

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